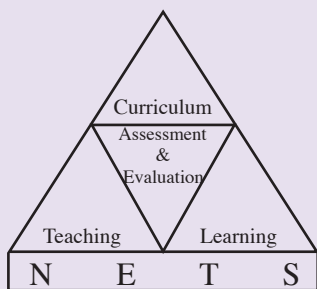


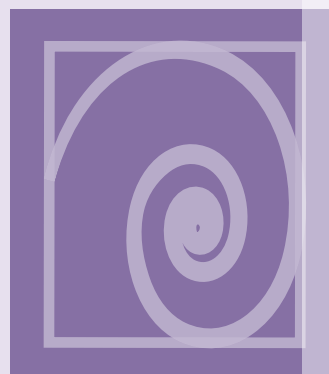
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Evaluation Report

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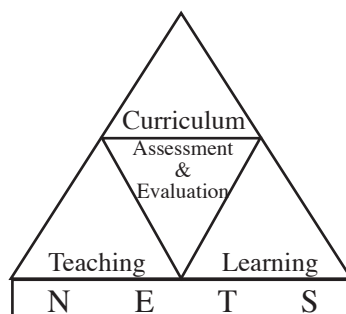
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Department of Examinations**



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32 - Mathematics



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Mathematics

Evaluation Report - G.C.E.(O.L.) Examination - 2015

Financial Aid

**Transforming the School Education System
as the Foundation of a Knowledge Hub Project
(TSEP-WB)**

INTRODUCTION

Out of all public examinations in Sri Lanka the largest number of candidates sit the G.C.E.(O.L.) Examination. The certificate received on the results of this examination which is conducted at national level, is used not only to select those who are eligible for higher education but also to secure medium level jobs and it is a basic requirement to follow certain courses of study in International Universities. It is thus accepted due to its validity and reliability as well as its high quality.

Students strive hard to acquire a high achievement level at this examination while their teachers as well as their parents work hard to fulfil the students' expectations. By preparing this Evaluation Report, the Department of Examinations intends to help students in achieving their goals. It is certain that the information included in this Evaluation Report will be equally useful to candidates, teachers, principals, subject directors, in-service advisors, parents and researchers on education.

This evaluation report prepared by the Research and Development Branch is based on the information, observations, ideas and suggestions provided by Chief Examiners, Additional Chief Examiners and Assistant Examiners involved in evaluation of answer scripts and the information drawn through the analyses of candidates' responses using the Classical Test Theory and the Item Response Theory.

This Evaluation Report consists of three parts, I, II and III. Part I contains the objectives of the subject and information on subject achievement. Part II contains expected answers for Paper I and Paper II, the marking scheme and the observations regarding answering questions and suggestions for further improvement. In Part III the factors to be considered by the candidate and suggestions for improvement regarding the learning - teaching process are highlighted. This part will be very useful to organize the learning - teaching process for the students to acquire various competencies and competency levels.

I would like to invite comments and suggestions to improve the quality of this report. I wish to extend my sincere thanks to the Controlling Examiners and other resource personnel for their dedication and contribution in the preparation of this report, and also the Chief / Additional Chief / Assistant Examiners for providing information, while appreciating the commitment of the staff members of the Department of Examinations to make this whole process a success.

W.M.N.J. Pushpakumara
Commissioner General of Examinations

30th November 2016
Research & Development Branch
National Evaluation & Testing Service
Department of Examinations.
Pelawatta, Battaramulla.

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Part I

1. Subject objectives and information on subject achievement

1.1 Subject objectives

The following objectives should be aimed at and achieved to further develop the mathematical concepts, creativity and sense of appreciation in students entering the junior secondary stage, so that their mathematical thinking, understanding and abilities are formally enhanced.

- * The development of computational skills through the provision of mathematical concepts and principles, as well as knowledge of mathematical operations, and the development of the basic skills of solving mathematical problems with greater understanding. (Knowledge and Skills)
- * The development of correct communication skills by enhancing the competencies of the proper use of oral, written, pictorial, graphical, concrete and algebraic methods. (Communication)
- * The development of connections between important mathematical ideas and concepts, and the use of these in the study and improvement of other subjects. The use of mathematics as a discipline that is relevant to lead an uncomplicated and satisfying life. (Seeing connections)
- * The enhancement of the skills of inductive and deductive reasoning to develop and evaluate mathematical conjectures and arguments. (Reasoning)
- * The development of the ability to use mathematical knowledge and techniques to formulate and solve problems, both familiar and unfamiliar and which are not limited to arithmetic or the symbolical, that arise in day to day life. (Problem Solving)

1.2. Information on subject achievement

1.2.1. The number of candidates who sat the examination

Medium	School	Private	Total
Sinhala	253239	27831	281070
Tamil	70444	26398	96842
English	10374	5601	15975
Total	334057	59830	393887

Table 1

1.2.2. Grades obtained by the candidates

Grade	School Candidates		Private Candidates		Total	Percentage
	Number	Percentage	Number	Percentage		
A	31830	9.53	965	1.61	32795	8.33
B	22047	6.60	1243	2.08	23290	5.91
C	50836	15.22	6355	10.62	57191	14.52
S	71639	21.45	15882	26.55	87521	22.22
W	157705	47.21	35385	59.14	193090	49.02
Total	334057	100.00	59830	100.00	393887	100.00

Table 2

1.2.3. Grades obtained by school candidates who sat the examination for the first time - District wise

District	Number Sat	Distinction (A)		Very Good Pass (B)		Credit Pass (C)		Ordinary Pass (S)		Pass (A+B+C+S)		Weak Pass (W)	
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
1. Colombo	31046	6369	20.51	3212	10.35	5603	18.05	5205	16.77	20389	65.67	10657	34.33
2. Gampaha	26609	3431	12.89	2359	8.87	4641	17.44	4935	18.55	15366	57.75	11243	42.25
3. Kalutara	15229	2084	13.68	1339	8.79	2516	16.52	2638	17.32	8577	56.32	6652	43.68
4. Kandy	18776	2076	11.06	1458	7.77	3113	16.58	3631	19.34	10278	54.74	8498	45.26
5. Matale	6400	534	8.34	421	6.58	974	15.22	1110	17.34	3039	47.48	3361	52.52
6. Nuwara Eliya	9414	574	6.10	523	5.56	1395	14.82	1865	19.81	4357	46.28	5057	53.72
7. Galle	14912	2176	14.59	1332	8.93	2616	17.54	2658	17.82	8782	58.89	6130	41.11
8. Matara	11340	1535	13.54	964	8.50	1951	17.20	2170	19.14	6620	58.38	4720	41.62
9. Hambantota	8481	895	10.55	684	8.07	1496	17.64	1760	20.75	4835	57.01	3646	42.99
10. Jaffna	9769	1339	13.71	774	7.92	1673	17.13	1702	17.42	5488	56.18	4281	43.82
11. Kilinochchi	2173	109	5.02	92	4.23	260	11.97	421	19.37	882	40.59	1291	59.41
12. Mannar	1639	83	5.06	83	5.06	296	18.06	394	24.04	856	52.23	783	47.77
13. Vavuniya	2531	242	9.56	189	7.47	386	15.25	506	19.99	1323	52.27	1208	47.73
14. Mullativu	1618	92	5.69	101	6.24	240	14.83	296	18.29	729	45.06	889	54.94
15. Batticaloa	7161	674	9.41	500	6.98	1085	15.15	1468	20.50	3727	52.05	3434	47.95
16. Ampara	8859	774	8.74	628	7.09	1611	18.18	1895	21.39	4908	55.40	3951	44.60
17. Trincomalee	5640	352	6.24	305	5.41	764	13.55	1117	19.80	2538	45.00	3102	55.00
18. Kurunegala	21693	2330	10.74	1833	8.45	3937	18.15	4441	20.47	12541	57.81	9152	42.19
19. Puttalam	9994	778	7.78	643	6.43	1533	15.34	1958	19.59	4912	49.15	5082	50.85
20. Anuradhapura	11522	898	7.79	794	6.89	1858	16.13	2222	19.28	5772	50.10	5750	49.90
21. Polonnaruwa	4991	372	7.45	324	6.49	729	14.61	927	18.57	2352	47.12	2639	52.88
22. Badulla	12028	993	8.26	803	6.68	2030	16.88	2276	18.92	6102	50.73	5926	49.27
23. Monaragala	6163	349	5.66	363	5.89	925	15.01	1164	18.89	2801	45.45	3362	54.55
24. Ratnapura	13751	1485	10.80	1027	7.47	2191	15.93	2447	17.80	7150	52.00	6601	48.00
25. Kegalle	10984	1198	10.91	874	7.96	1918	17.46	2167	19.73	6157	56.05	4827	43.95
All Island	272723	31742	11.64	21625	7.93	45741	16.77	51373	18.84	150481	55.18	122242	44.82

Table 3

**1.2.4. Grades obtained by school candidates who sat the examination for the first time
- Zonal wise**

Education Zone	Number Sat	Distinction (A)		Very Good Pass (B)		Credit Pass (C)		Ordinary Pass (S)		Pass (A+B+C+S)		Weak Pass (W)	
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
1. Colombo	14467	4138	28.6	1535	10.61	2473	17.09	2104	14.54	10250	70.85	4217	29.15
2. Homagama	3584	263	7.34	276	7.7	598	16.69	653	18.22	1790	49.94	1794	50.06
3. Jayawardanapura	7253	1068	14.72	800	11.03	1464	20.18	1452	20.02	4784	65.96	2469	34.04
4. Piliyandala	5742	909	15.83	599	10.43	1062	18.5	1014	17.66	3584	62.42	2158	37.58
5. Gampaha	7523	1530	20.34	771	10.25	1283	17.05	1249	16.6	4833	64.24	2690	35.76
6. Minuwangoda	5072	407	8.02	416	8.2	872	17.19	1018	20.07	2713	53.49	2359	46.51
7. Negombo	6958	746	10.72	582	8.36	1200	17.25	1333	19.16	3861	55.49	3097	44.51
8. Kelaniya	7056	753	10.67	587	8.32	1284	18.2	1349	19.12	3973	56.31	3083	43.69
9. Kalutara	7668	1055	13.76	669	8.72	1319	17.2	1349	17.59	4392	57.28	3276	42.72
10. Matugama	3041	459	15.09	297	9.77	467	15.36	490	16.11	1713	56.33	1328	43.67
11. Horana	4520	573	12.68	371	8.21	729	16.13	810	17.92	2483	54.93	2037	45.07
12. Kandy	6943	1565	22.54	861	12.4	1336	19.24	1210	17.43	4972	71.61	1971	28.39
13. Denuwara	1867	63	3.37	109	5.84	269	14.41	388	20.78	829	44.4	1038	55.6
14. Gampola	3172	139	4.38	154	4.85	421	13.27	647	20.4	1361	42.91	1811	57.09
15. Teldeniya	1621	77	4.75	65	4.01	264	16.29	325	20.05	731	45.1	890	54.9
16. Wattagama	2300	94	4.09	107	4.65	382	16.61	482	20.96	1065	46.3	1235	53.7
17. Katugastota	2873	147	5.12	155	5.4	439	15.28	595	20.71	1336	46.5	1537	53.5
18. Matale	3463	414	11.95	259	7.48	587	16.95	612	17.67	1872	54.06	1591	45.94
19. Galewela	1934	86	4.45	117	6.05	244	12.62	336	17.37	783	40.49	1151	59.51
20. Naula	453	8	1.77	15	3.31	65	14.35	97	21.41	185	40.84	268	59.16
21. Wilgamuwa	550	27	4.91	29	5.27	79	14.36	75	13.64	210	38.18	340	61.82
22. Nuwara Eliya	2624	104	3.96	116	4.42	403	15.36	569	21.68	1192	45.43	1432	54.57
23. Kotmale	1286	90	7	68	5.29	196	15.24	237	18.43	591	45.96	695	54.04
24. Hatton	2708	203	7.5	159	5.87	393	14.51	536	19.79	1291	47.67	1417	52.33
25. Walapane	1298	55	4.24	65	5.01	176	13.56	278	21.42	574	44.22	724	55.78
26. Hanguranketha	1498	122	8.14	115	7.68	227	15.15	253	16.89	717	47.86	781	52.14
27. Galle	6889	1341	19.47	727	10.55	1250	18.14	1119	16.24	4437	64.41	2452	35.59
28. Elpitiya	3106	212	6.83	219	7.05	525	16.9	612	19.7	1568	50.48	1538	49.52
29. Ambalangoda	3151	513	16.28	265	8.41	506	16.06	574	18.22	1858	58.97	1293	41.03
30. Udugama	1766	116	6.57	116	6.57	334	18.91	368	20.84	934	52.89	832	47.11
31. Matara	5131	1002	19.53	542	10.56	908	17.7	914	17.81	3366	65.6	1765	34.4
32. Akuressa	1961	224	11.42	167	8.52	340	17.34	368	18.77	1099	56.04	862	43.96
33. Mulatiyana	1982	179	9.03	145	7.32	358	18.06	429	21.64	1111	56.05	871	43.95
34. Morawaka	2266	130	5.74	110	4.85	345	15.23	460	20.3	1045	46.12	1221	53.88

Education Zone	Number Sat	Distinction (A)		Very Good Pass (B)		Credit Pass (C)		Ordinary Pass (S)		Pass (A+B+C+S)		Weak Pass (W)	
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
35. Tangalle	2390	256	10.71	164	6.86	401	16.78	521	21.8	1342	56.15	1048	43.85
36. Hambantota	3606	286	7.93	290	8.04	608	16.86	752	20.85	1936	53.69	1670	46.31
37. Walasmulla	2485	353	14.21	230	9.26	487	19.6	489	19.68	1559	62.74	926	37.26
38. Jaffna	3516	706	20.08	315	8.96	649	18.46	600	17.06	2270	64.56	1246	35.44
39. Islands	712	32	4.49	35	4.92	87	12.22	119	16.71	273	38.34	439	61.66
40. Thenmarachchi	1005	81	8.06	66	6.57	141	14.03	173	17.21	461	45.87	544	54.13
41. Valikamam	2901	235	8.1	197	6.79	501	17.27	585	20.17	1518	52.33	1383	47.67
42. Vadamarachchi	1635	285	17.43	162	9.91	295	18.04	231	14.13	973	59.51	662	40.49
43. Kilinochchi	2173	109	5.02	92	4.23	260	11.97	421	19.37	882	40.59	1291	59.41
44. Mannar	1323	79	5.97	73	5.52	251	18.97	325	24.57	728	55.03	595	44.97
45. Madu	312	5	1.6	10	3.21	48	15.38	71	22.76	134	42.95	178	57.05
46. Vavuniya South	2059	229	11.12	166	8.06	331	16.08	411	19.96	1137	55.22	922	44.78
47. Vavuniya North	485	13	2.68	23	4.74	55	11.34	95	19.59	186	38.35	299	61.65
48. Mullaitivu	1122	70	6.24	79	7.04	167	14.88	199	17.74	515	45.9	607	54.1
49. Thunukkai	496	22	4.44	23	4.64	72	14.52	97	19.56	214	43.15	282	56.85
50. Batticaloa	2149	303	14.1	183	8.52	347	16.15	410	19.08	1243	57.84	906	42.16
51. Kalkudah	1069	32	2.99	57	5.33	123	11.51	235	21.98	447	41.81	622	58.19
52. Paddirippu	1352	89	6.58	86	6.36	206	15.24	235	17.38	616	45.56	736	54.44
53. Batticaloa (Central)	1650	214	12.97	143	8.67	299	18.12	380	23.03	1036	62.79	614	37.21
54. Batticaloa (West)	941	36	3.83	31	3.29	110	11.69	210	22.32	387	41.13	554	58.87
55. Ampara	2171	184	8.48	126	5.8	318	14.65	439	20.22	1067	49.15	1104	50.85
56. Kalmunai	2149	255	11.87	188	8.75	437	20.34	455	21.17	1335	62.12	814	37.88
57. Sammanthurai	1265	82	6.48	96	7.59	253	20	308	24.35	739	58.42	526	41.58
58. Mahaoya	518	20	3.86	23	4.44	75	14.48	109	21.04	227	43.82	291	56.18
59. Dehiattakandiya	860	59	6.86	52	6.05	167	19.42	177	20.58	455	52.91	405	47.09
60. Akkaraipattu	1064	107	10.06	75	7.05	208	19.55	269	25.28	659	61.94	405	38.06
61. Thirukkovil	832	67	8.05	68	8.17	153	18.39	139	16.71	427	51.32	405	48.68
62. Trincomalee	1689	187	11.07	115	6.81	248	14.68	348	20.6	898	53.17	791	46.83
63. Mutur	1213	51	4.2	54	4.45	173	14.26	244	20.12	522	43.03	691	56.97
64. Kantale	876	54	6.16	61	6.96	126	14.38	175	19.98	416	47.49	460	52.51
65. Kinnya	1296	47	3.63	58	4.48	177	13.66	274	21.14	556	42.9	740	57.1
66. Trincomalee (North)	566	13	2.3	17	3	40	7.07	82	14.49	152	26.86	414	73.14
67. Kurunegala	5409	901	16.66	507	9.37	933	17.25	1021	18.88	3362	62.16	2047	37.84
68. Kuliyaipitiya	3890	486	12.49	375	9.64	725	18.64	785	20.18	2371	60.95	1519	39.05
69. Nikaweratiya	2590	188	7.26	238	9.19	550	21.24	540	20.85	1516	58.53	1074	41.47
70. Maho	3337	201	6.02	196	5.87	541	16.21	761	22.8	1699	50.91	1638	49.09
71. Giriulla	3538	296	8.37	302	8.54	676	19.11	759	21.45	2033	57.46	1505	42.54
72. Ibbagamuwa	2929	259	8.84	217	7.41	509	17.38	587	20.04	1572	53.67	1357	46.33
73. Puttalam	4733	218	4.61	225	4.75	650	13.73	968	20.45	2061	43.55	2672	56.45
74. Chilaw	5252	561	10.68	417	7.94	879	16.74	998	19	2855	54.36	2397	45.64

Education Zone	Number Sat	Distinction (A)		Very Good Pass (B)		Credit Pass (C)		Ordinary Pass (S)		Pass (A+B+C+S)		Weak Pass (W)	
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
75. Anuradhapura	4148	490	11.81	375	9.04	703	16.95	727	17.53	2295	55.33	1853	44.67
76. Tambuttegama	1993	98	4.92	114	5.72	295	14.8	393	19.72	900	45.16	1093	54.84
77. Kekirawa	2280	161	7.06	144	6.32	361	15.83	433	18.99	1099	48.2	1181	51.8
78. Galenbidunuwewa	1458	67	4.6	67	4.6	240	16.46	316	21.67	690	47.33	768	52.67
79. Kebithigollewa	1643	86	5.23	91	5.54	258	15.7	363	22.09	798	48.57	845	51.43
80. Polonnaruwa	1641	194	11.82	144	8.78	276	16.82	281	17.12	895	54.54	746	45.46
81. Hingurakgoda	2117	147	6.94	138	6.52	308	14.55	376	17.76	969	45.77	1148	54.23
82. Dimbulagala	1233	33	2.68	41	3.33	144	11.68	274	22.22	492	39.9	741	60.1
83. Badulla	2567	301	11.73	208	8.1	477	18.58	456	17.76	1442	56.17	1125	43.83
84. Bandarawela	3290	414	12.58	271	8.24	610	18.54	619	18.81	1914	58.18	1376	41.82
85. Mahiyanganaya	1794	87	4.85	88	4.91	244	13.6	289	16.11	708	39.46	1086	60.54
86. Welimada	2434	123	5.05	162	6.66	429	17.63	523	21.49	1237	50.82	1197	49.18
87. Passara	1095	30	2.74	44	4.02	154	14.06	240	21.92	468	42.74	627	57.26
88. Viyaluwa	848	38	4.48	30	3.54	116	13.68	155	18.28	339	39.98	509	60.02
89. Monaragala	1983	93	4.69	102	5.14	314	15.83	382	19.26	891	44.93	1092	55.07
90. Wellawaya	2769	185	6.68	162	5.85	412	14.88	477	17.23	1236	44.64	1533	55.36
91. Bibile	1411	71	5.03	100	7.09	198	14.03	311	22.04	680	48.19	731	51.81
92. Ratnapura	5760	890	15.45	519	9.01	929	16.13	970	16.84	3308	57.43	2452	42.57
93. Balangoda	2539	217	8.55	177	6.97	388	15.28	443	17.45	1225	48.25	1314	51.75
94. Nivitigala	2169	134	6.18	134	6.18	378	17.43	446	20.56	1092	50.35	1077	49.65
95. Embilipitiya	3283	245	7.46	196	5.97	496	15.11	593	18.06	1530	46.6	1753	53.4
96. Kegalle	4212	705	16.74	409	9.71	754	17.9	754	17.9	2622	62.25	1590	37.75
97. Mawanella	3477	339	9.75	255	7.33	583	16.77	698	20.07	1875	53.93	1602	46.07
98. Dehiowita	3295	159	4.83	207	6.28	579	17.57	731	22.19	1676	50.86	1619	49.14
All Island	272723	31742	11.64	21625	7.93	45741	16.77	51373	18.84	150481	55.18	122242	44.82

Table 4

1.2.5. Marks obtained based on class intervals

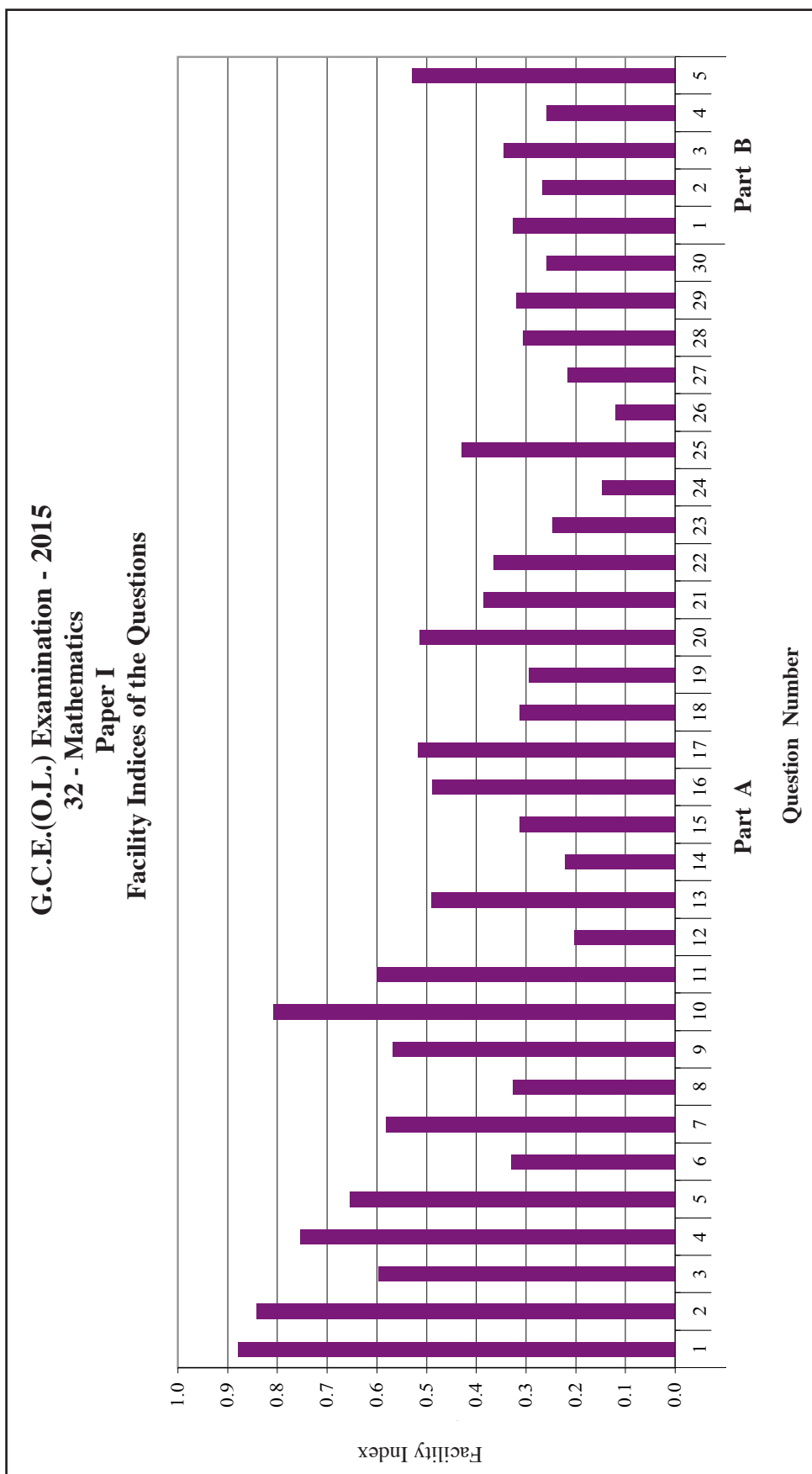
Class Interval	Frequency	Frequency Percentage	Cumulative Frequency	Cumulative Frequency Percentage
91 - 100	1568	0.40	393887	100.00
81 - 90	9884	2.51	392319	99.60
71 - 80	19072	4.84	382435	97.09
61 - 70	22683	5.76	363363	92.25
51 - 60	29277	7.43	340680	86.49
41 - 50	35169	8.93	311403	79.06
31 - 40	58214	14.78	276234	70.13
21 - 30	66732	16.94	218020	55.35
11 - 20	75450	19.16	151288	38.41
01 - 10	73160	18.57	75838	19.25
00 - 00	2678	0.68	2678	0.68

Table 5

According to the above table, out of 393887 candidates who sat for the subject Mathematics, the number that obtained marks within the class interval 31 - 40, is 58214. As a percentage this is 14.78%. The number that obtained a mark of 40 or less is 276234, which is 70.13% as a percentage.

1.3. Analysis of Subject Achievement

1.3.1. Achievement in Paper I



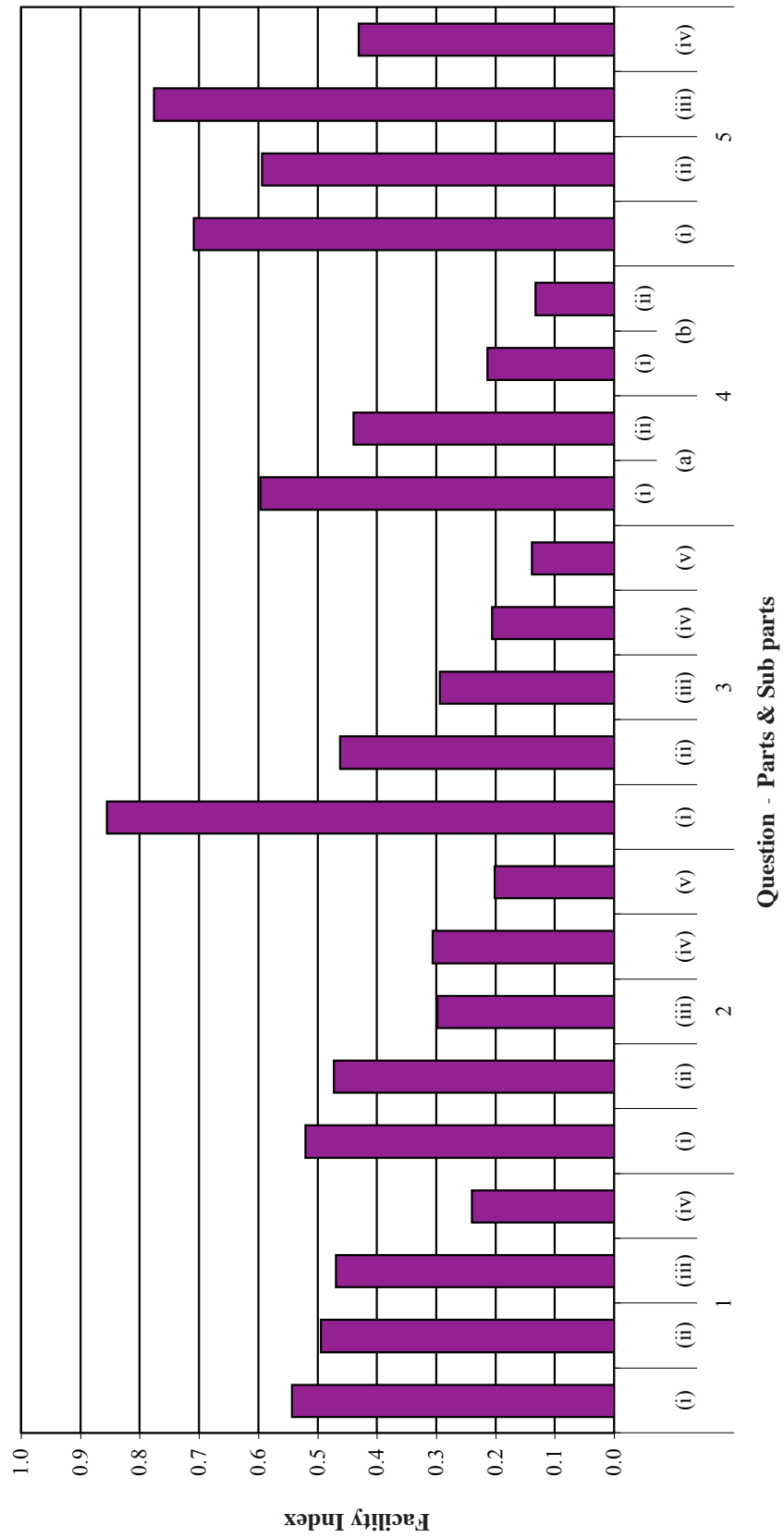
Graph 1 (Based on the information gathered from the form RD/16/05/OL)
According to the above graph, Question 1 has the greatest facility from the questions in Part A of Paper I. Its facility is 88%.
Question 26 has the least facility which is 12%.
Question 5 has the greatest facility from the questions in Part B of Paper I. Its facility is 53%. Question 4 has the least facility which is 26%.

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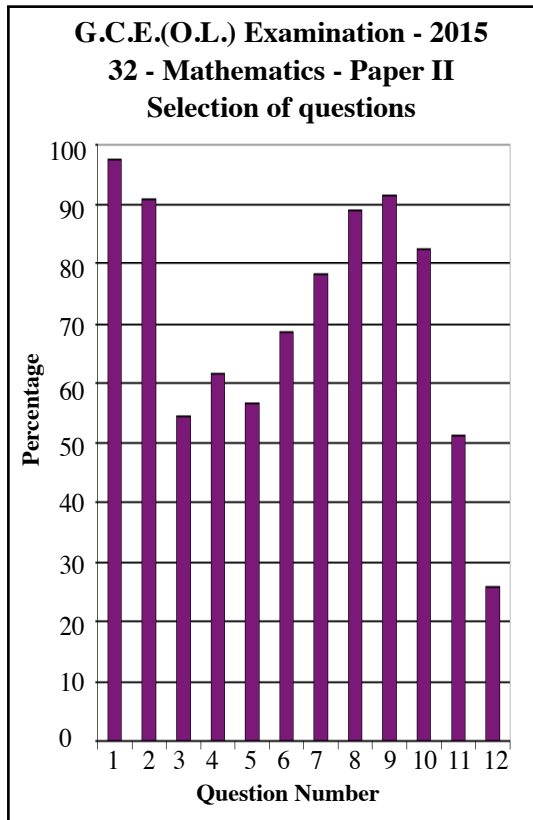
Paper I (Part B)

Facility Indices of Parts and Sub Parts of each Question



Graph 2 (Based on the information gathered from the form RD/16/04/OL)

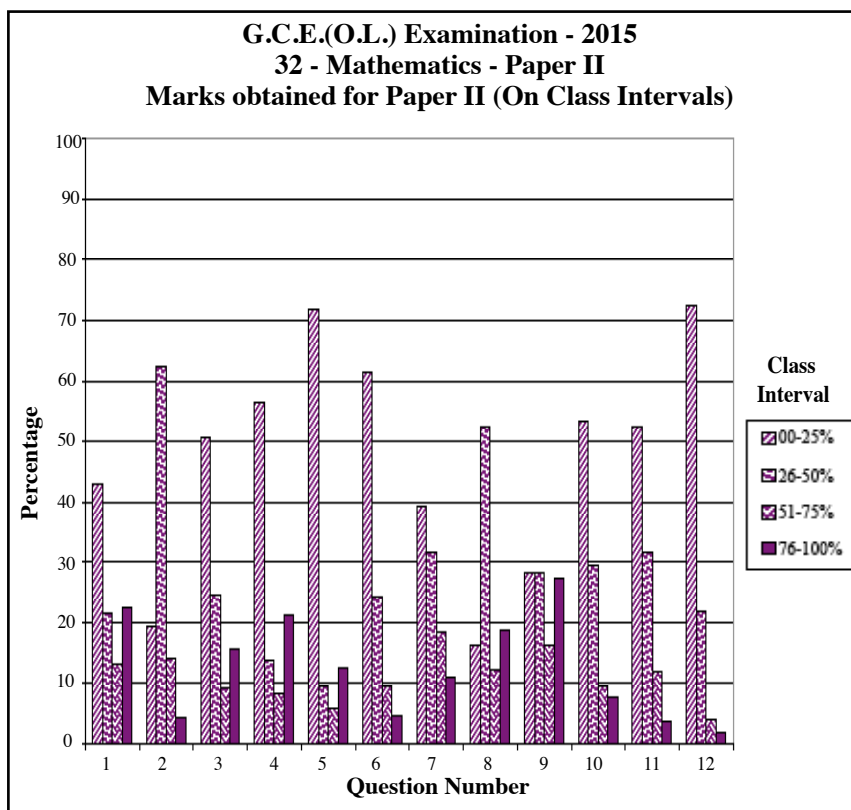
1.3.2. Selection of questions in Paper II



According to this graph, the first question in paper II which is based on the theme 'Numbers' has the highest selection. As a percentage it is 98%. The 12th question based on the theme 'Geometry' has the least selection. As a percentage it is 26%.

Graph 3 (Based on the information gathered from the form RD/16/02/OL)

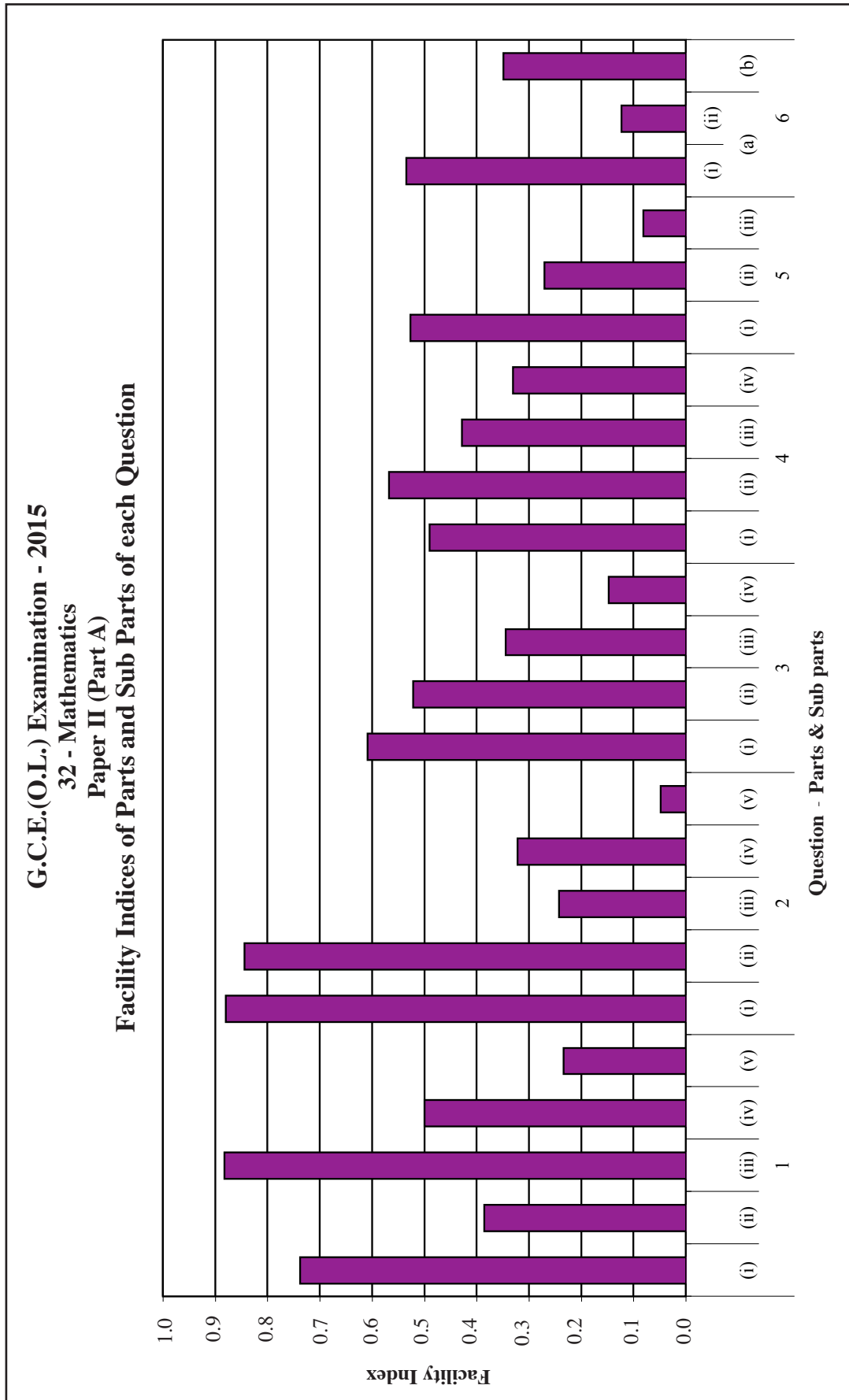
1.3.3. Marks obtained for questions in Paper II



Each question in this paper carries 10 marks. For question 1, the percentage that has obtained marks in the interval 76%–100%, that is, from 8 to 10 marks is about 22%. The percentage that has obtained marks in the interval 51%–75%, that is from 6 to 7 marks is about 13%. The percentage that has obtained marks in the interval 26%–50%, that is, from 3 to 5 marks is about 21%. The percentage that has obtained marks in the interval 00% – 25%, that is, from 0 to 2 marks is about 44%.

Graph 4 (Based on the information gathered from the form RD/16/02/OL)

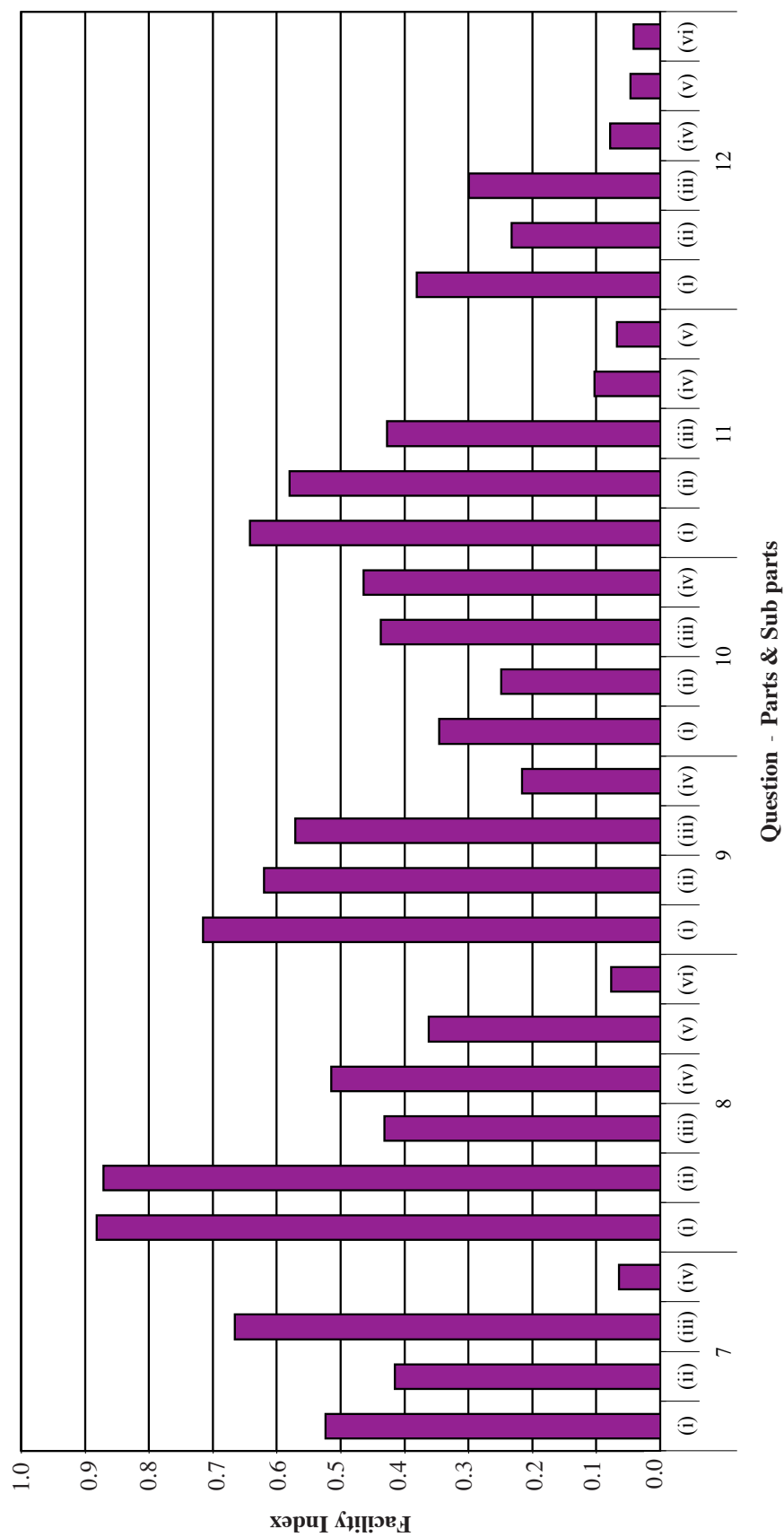
1.3.4 Achievement in Paper II



Graph 5.1 (Based on the information gathered from the form RD/16/04/OL)
 According to the above graph, Part (iii) of question 1 has the greatest facility from Part A of Paper II. Its facility is 89%.
 Part (v) of question 2 has the least facility which is 5%.

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Paper II (Part B)

Facility Indices of Parts and Sub Parts of each Question



Graph 5.II (Based on the information gathered from the form RD/16/04/OL)

Part II

2. Information on the questions and answers

2.1 Paper I

2.1.1 Structure of Paper I

- ★ Time : 02 hours. Marks : 50
- ★ This paper consists of two parts, **A** and **B**. All questions included in these two parts are compulsory.

Part A

This part consists of 30 questions which require short answers. It is based on all the themes and covers the entire mathematics syllabus.

1 mark each for questions 1 to 10, with a total of 10 marks.

2 marks each for questions 11 to 30, with a total of 40 marks.

Total marks for Part A is 50 marks.

Part B

This part consists of 5 structured questions on the themes Numbers, Measurements, Statistics and, Sets and Probability. These questions are based on the competencies that are closely related to daily life.

10 marks for each question, with a total of 50 marks for Part B.

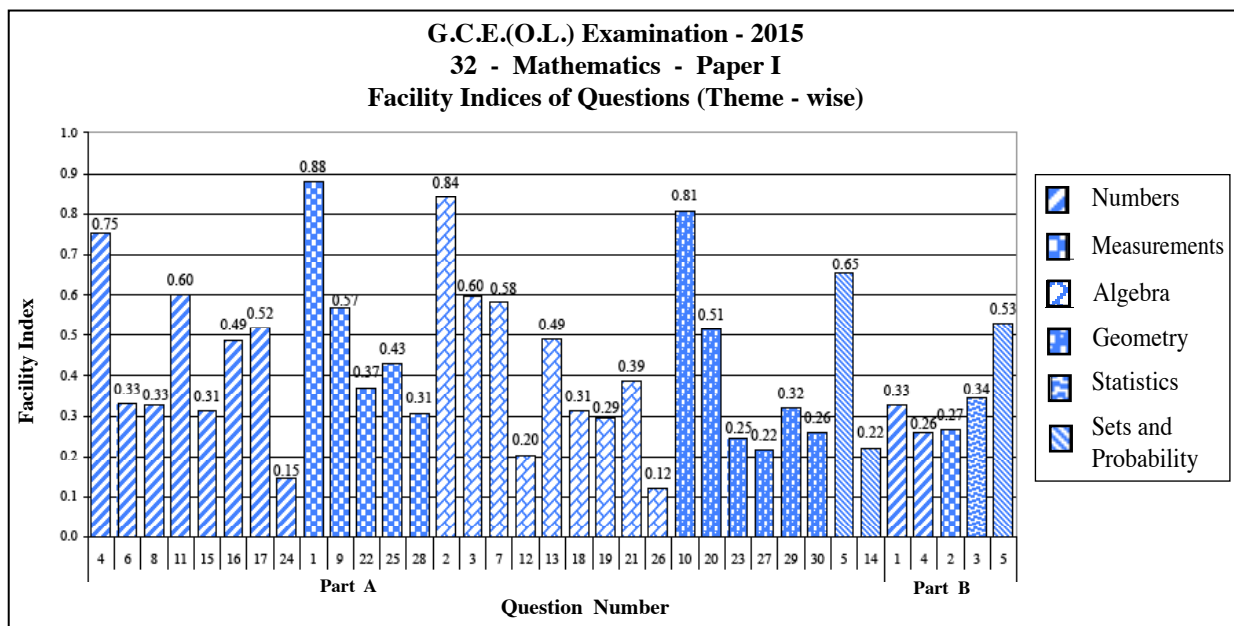
Part A - 50 marks

Part B - 50 marks

Total marks for Paper I - 100 marks

Final marks for Paper I - $100 \div 2 = 50$

2.1.2 Observations (theme-wise) on the answers to Paper I

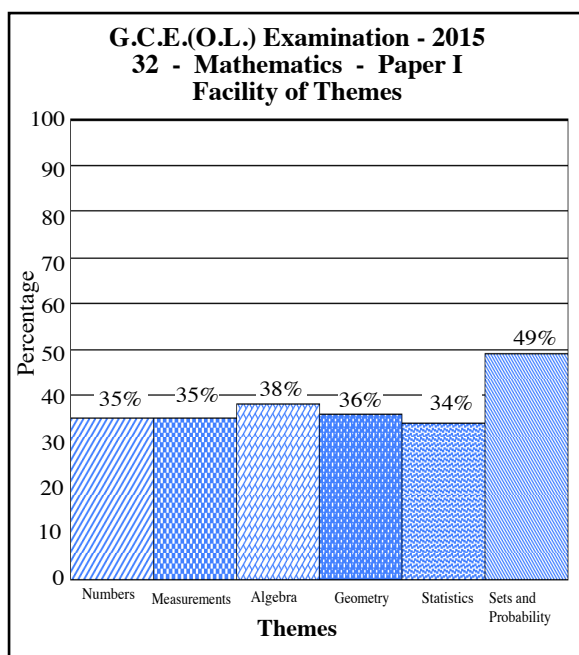


Graph 6.I

Questions in Mathematics Paper I belonging to each theme

Theme	Questions of Part A	No. of questions	Questions of Part B	No. of questions
1. Numbers	4, 6, 8, 11, 15, 16, 17, 24	8	1, 4	2
2. Measurements	1, 9, 22, 25, 28	5	2	1
3. Algebra	2, 3, 7, 12, 13, 18, 19, 21, 26	9	-	-
4. Geometry	10, 20, 23, 27, 29, 30	6	-	-
5. Statistics	-	-	3	1
6. Sets and Probability	5, 14	2	5	1

Table 6



Graph 6.II

The facility of each theme has been calculated and presented in this graph, by considering how the candidates have answered all the questions in parts A and B of paper I.

Questions based on the theme 'Sets and Probability' out of the 6 themes, show the highest facility, 49%. Furthermore, the theme 'Statistics' shows the least facility, 34%.

The facilities of all the themes of paper I are less than 50%. However the facilities of all the themes are greater than or equal to 34%.

The overall facility of paper I is 37%.

Part A

Part A of Paper I consists of 30 questions with simple calculations. The questions with the highest and lowest facilities are included theme-wise in the following chart.

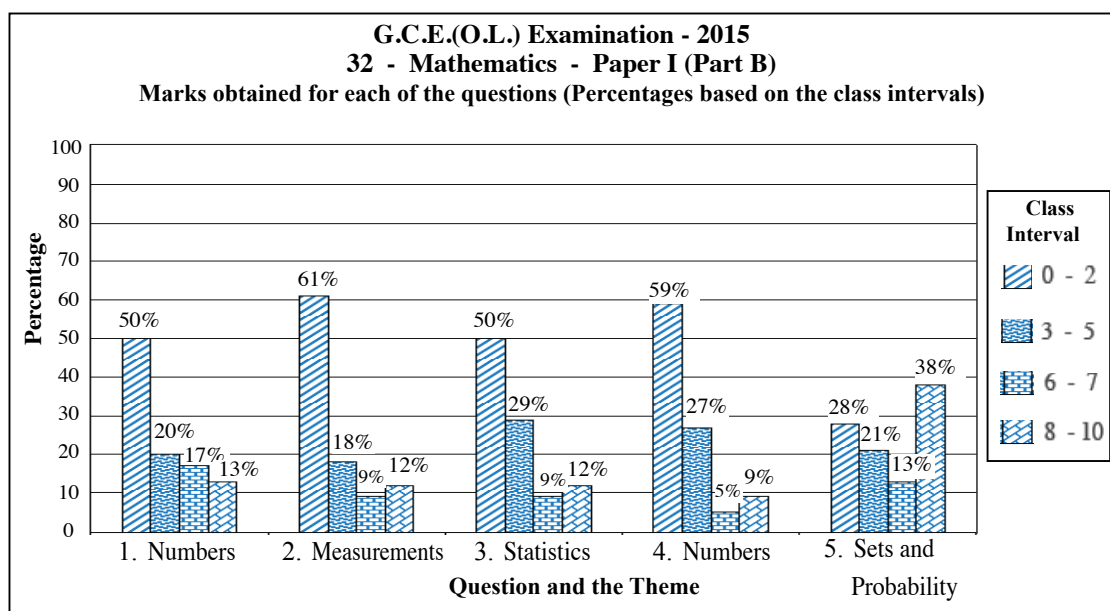
Theme	No. of Questions	The easiest question and its facility	The hardest question and its facility
1. Numbers	8	4 (75%)	24 (15%)
2. Measurements	5	1 (88%)	28 (31%)
3. Algebra	9	2 (84%)	26 (12%)
4. Geometry	6	10 (81%)	27 (22%)
5. Statistics	-	-	-
6. Sets and Probability	2	5 (65%)	14 (22%)

Table 7

Question 1 under the theme 'Measurements' is the easiest with a facility of 88%, while question 26 based on the theme 'Algebra' shows the lowest facility of 12%.

Part B

Part B of Paper I consists of 5 questions which carry 10 marks each. The performance of the candidates in these questions is given below.



Graph 6.III (Based on the information gathered from the form RD/16/05/OL)

Part B of Paper I consists of 2 questions from the theme 'Numbers' and 1 question each from 'Measurements', 'Statistics' and 'Sets and Probability'.

The percentage of candidates who obtained more than 75% of the marks allocated for each question is 13%, 12%, 12%, 9% and 38% in the order of the question numbers. Accordingly, the question which has been somewhat easy to score marks is question 5 while question 4 has been the most difficult.

The percentage of candidates who obtained less than 25% of the marks allocated for each question is 50%, 61%, 50%, 59% and 28% in the order of the question numbers. Accordingly, the lowest percentage of candidates with the lowest marks (below 25%) is recorded for question 5 and the highest percentage is recorded for question 4.

The percentage of candidates who have obtained more than half of the allocated marks for questions 1 – 5 is 30%, 21%, 21%, 14% and 51% respectively. This too reveals that the most difficult question has been question 4 and the question which has been somewhat easy to score marks in is question 5.

2.1.3 Marks obtained for each question in Part A of Paper I - Percentages

Question Number	Marks allocated	Percentage of candidates who have obtained 0, 1 or 2 marks			
		0	1	2	9 *
1	1	12%	88%		0%
2	1	15%	84%		1%
3	1	38%	60%		2%
4	1	22%	75%		3%
5	1	28%	65%		7%
6	1	57%	33%		10%
7	1	35%	58%		7%
8	1	60%	33%		7%
9	1	41%	57%		2%
10	1	17%	80%		3%
11	2	27%	21%	50%	2%
12	2	70%	0%	20%	10%
13	2	44%	2%	48%	6%
14	2	59%	3%	21%	17%
15	2	61%	5%	29%	5%
16	2	43%	9%	45%	3%
17	2	35%	17%	43%	5%
18	2	52%	19%	22%	7%
19	2	61%	1%	29%	9%
20	2	40%	6%	49%	5%
21	2	48%	10%	34%	8%
22	2	44%	17%	28%	11%
23	2	64%	1%	24%	11%
24	2	72%	1%	14%	13%
25	2	37%	20%	33%	10%
26	2	64%	5%	9%	22%
27	2	59%	19%	12%	10%
28	2	42%	10%	26%	22%
29	2	46%	9%	27%	18%
30	2	55%	4%	24%	17%

Table 8

* Note: Column 9 denotes the percentage of students who have not attempted to answer each question.

2.1.4 Expected answers for Paper I, Marking scheme, Observations, Conclusions and Suggestions.

The details related to the questions in Paper I are taken from the graph 1 found on page 8 and the table found on page 16.

Part A

- Only 1 mark is allocated for each question from question No. 1 to No. 10. Here, only the basic concepts are tested, and hence even the final answer is accepted.
- 2 marks are allocated for each question from question No. 11 to No. 30. Candidates should be encouraged not to write only the final answer. It is important to write the correct steps which will secure partial marks even if the final answer is wrong. Candidates should also be educated to write the units in standard form.

1. Express 2000 metres in kilometres.

Expected Answer 2

1 mark

Observations and conclusions

This question tests the knowledge and ability in converting units. The facility of the question is 88%. It is the question which is answered best out of the 30 questions in Paper I.

2. Solve: $5x = 20$

Expected Answer $x = 4$ or 4

1 mark

Observations and conclusions

This is a simple equation which can be solved in a single step. The facility of the question is 84%. Candidates should practice verifying the answer by substituting the obtained value in the original equation.

3. Simplify: $5a \times a^2$

Expected Answer $5a^3$

1 mark

Observations and conclusions

This question has been set to test the ability in using the basic laws of indices. The facility of the question is 60%. Candidates should practice simplifying indices using the basic laws of indices.

4. Find 60% of Rs 20.

Expected Answer Rs. 12 or 12

1 mark

Observations and conclusions

This question with facility of 75% tests the ability in calculating a certain percentage of a given quantity. The high facility is a favourable tendency.

5. If $A = \{\text{integer multiples of } 2\}$ and $B = \{\text{integer multiples of } 3\}$, then write down one element of $A \cap B$.

Expected Answer Integral multiple of 6

1 mark

Observations and conclusions

This question tests the understanding on set operations and the ability to identify multiples of a given number. Its facility is 65%. It is important to emphasize the accurate procedure in answering questions related to sets.

6. Write down 101_{two} in base ten.

Expected Answer 5

1 mark

Observations and conclusions

This question tests the ability in converting a binary number into a decimal number. 33% of the candidates have answered this correctly. Here it is important to use the place value of the digits of the binary number accurately.

7. Make p the subject of the formula $pq - r = u$.

Expected Answer $p = \frac{u+r}{q}$

1 mark

Observations and conclusions

This question is set to measure the ability in making a required term the subject of a given formula. Only 58% have answered this question correctly. This skill can be enhanced by practicing making any term the subject of a formula.

8. Simplify: $\log_3 9$

Expected Answer 2

1 mark

Observations and conclusions

This question with facility of 33% tests the ability in calculating the logarithm of a number to a given base. A majority had failed to obtain the correct answer due to not identifying $9 = 3^2$, though they identified $9 = 3 \times 3$. It is important to train candidates to state the given expression as a logarithmic equation and understand the relationship between the logarithmic equation and the corresponding index equation.

9. Find the time taken by a vehicle travelling at a uniform speed of 100 kilometres per hour to travel a distance of 25 kilometres.

Expected Answer $\frac{1}{4}$ hr or $\frac{1}{4}$ 15 minutes or 15

1 mark

Observations and conclusions

This question can be answered using the unitary method or proportions. Facility of this question is 57%. Solving this type of questions should be practiced as it is necessary in day to day life.

10. If the sum of two interior angles of a triangle is 100° , write down the magnitude of the remaining interior angle in degrees.

Expected Answer 80°

1 mark

Observations and conclusions

This is a simple geometrical problem based on the fact that the sum of the three interior angles of a triangle is 180° . Its facility is 81%.

11. The profit made by a trading company on Sunday is 20% more than the profit made on Monday. If the profit on Monday is Rs 8 000, then find the profit on Sunday.

Expected Answer Rs. 9600 or 9600 (2)

2 marks

$8000 \times \frac{120}{100}$ or $8000 \times \frac{20}{100}$ 1

Observations and conclusions

The facility of this question which has been given to test the knowledge on percentages is 60%. The knowledge on percentages should be further enhanced. This problem can also be solved by using the unitary method.

12. Find the least common multiple of the two algebraic expressions $x(x + 2)$ and x^2 .

Expected Answer $x^2(x + 2)$ **2 marks**

Observations and conclusions

This question which measures the ability in finding the L.C.M. of algebraic expressions has a low facility of 20%. This low facility level is due to the lack of familiarity with the method of finding the L.C.M. of algebraic terms and expressions. Therefore, it is important to get the candidates engaged in doing more exercises for a better understanding.

13. Find the factors: $x^2 + 3x - 10$

Expected Answer $(x + 5)(x - 2)$ (2) **2 marks**
 $x^2 + 5x - 2x - 10$ 1

Observations and conclusions

This question on factorizing a trinomial quadratic expression has a facility of 49%. The lack of understanding on simplifying integers and not expressing $3x$ as $5x - 2x$ has resulted in the failure to obtain the answer. Exercises should be done with an understanding of the rules of simplifying integers.

14. If the two events A and B are mutually exclusive and $P(A) = P(B) = \frac{1}{5}$, then find $P((A \cup B)')$.

Expected Answer $\frac{3}{5}$ (2) **2 marks**
 $P(A \cup B) = \frac{1}{5} + \frac{1}{5}$ 1

Observations and conclusions

The facility of this question is 22%. The candidates seem to have forgotten the requirement for two events to be mutually exclusive and the fact that the sum of the probability of an event and the probability of its complement is one.

15. The first Rs 500 000 of the annual income of a person is free of income tax and the next Rs 500 000 is subject to 4% income tax. Find the income tax that should be paid by a person who earns an annual income of Rs 600 000.

Expected Answer Rs. 4000 or 4000 (2) **2 marks**
Identifying Rs. 100 000 1

Observations and conclusions

The facility of this question is 31%. Attention has not been paid to the tax free income and this has caused the low facility. This weakness can be overcome by solving more exercises related to calculating income taxes.

16. If a bank pays an annual compound interest rate of 10%, find the total amount of money at the end of two years, in an account opened with a deposit of Rs 100 in this bank.

Expected Answer Rs. 121 (2) **2 marks**

$$100 \times \frac{110}{100} \text{ or } 100 + 100 \times \frac{10}{100} \text{ or}$$

$$100 \times \frac{110}{100} \times \frac{110}{100} \dots\dots\dots 1$$

Observations and conclusions

This problem on compound interest has a facility of 49%. Obtaining the interest by calculating the simple interest for two years was a common weakness witnessed here. The fact that the method of calculating compound interest differs from that of simple interest, should be understood and practiced.

17. The second and third terms of a geometric progression are 6 and 18 respectively. Find its
(i) common ratio

(ii) first term.

Expected Answer (i) 3 (1)

(ii) 2 (1)

2 marks

Observations and conclusions

The facility of this simple geometric progression problem is 52% due to not using the method of obtaining the common ratio accurately. Problems related to finding the common ratio and another term using given consecutive terms should be practiced more.

18. Solve the inequality $1 - 2x \leq 7$.

Expected Answer $x \geq -3$ (2)

$$-2x \leq 7 - 1 \text{ or } 1 - 7 \leq 2x \dots\dots\dots 1$$

2 marks

Observations and conclusions

The facility of this question on solving an inequality is 31%. It is mainly due to the unawareness of the fact that the inequality changes when divided by a negative integer. More exercises that consolidate the features of inequalities should be done to minimize this weakness.

19. If the straight line given by the equation $y = 2x + c$ passes through the point (1,5), then find the value of c .

Expected Answer 3 (2)

$$5 = 2 \times 1 + c \dots\dots\dots 1$$

2 marks

Observations and conclusions

The facility of this question on finding the intercept of the graph of a straight line is 29%. The inability to identify that the co-ordinates of a point on a straight line satisfy the equation is the reason for this low facility. Candidates should be involved in exercises to establish the fact that by substituting the co-ordinates of a given point in the equation of the function m or c can be found.

20. Using the information given in the figure, find the value of x .

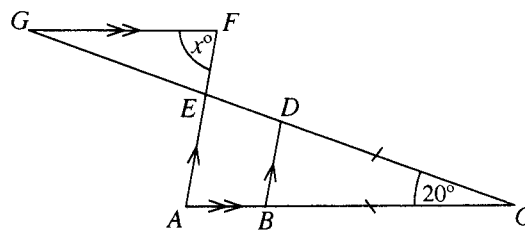
Expected Answer

80 or 80° (2)

Identifying \hat{CBD} , \hat{CDB} , \hat{BAE} or

$\hat{DEA} = 80^\circ$ or x°

or identifying $\hat{FGE} = 20^\circ$ 1



2 marks

Observations and conclusions

The facility of this question on angles related to parallel lines and isosceles triangles is 51%. This is due to not identifying alternate angles and corresponding angles and the angles in an isosceles triangle. This weakness can be overcome by encouraging candidates to do different exercises on angles related to parallel lines as well as triangles.

21. Given that $\begin{pmatrix} -1 & 0 \\ x & y \end{pmatrix} + \begin{pmatrix} 3 & 2 \\ 0 & x \end{pmatrix} = 2\begin{pmatrix} 1 & 1 \\ 2 & 6 \end{pmatrix}$, find the values of x and y .

Expected Answer $x = 4$ (1)

$y = 8$ (1)

2 marks

Observations and conclusions

This question which tests the knowledge on adding matrices and multiplying a matrix by a whole number has a facility of 39%. The correct answer can be achieved by identifying corresponding elements correctly and building up relationships between x and y .

22. The circumference of the base of a cone is 16π centimetres. Find
 (i) the radius of the base
 (ii) the perpendicular height if the slant height is 10 cm.

Expected Answer (i) 8 cm or 8 (1)

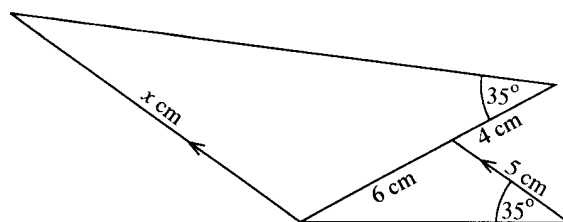
(ii) 6 cm or 6 (1)

2 marks

Observations and conclusions

The facility of this question related to measurements is 37%. The inability to visualize the circular base of a cone or not drawing it, could have been the cause for the low facility. The radius of the base can be found using the formula for the circumference while the perpendicular height can be found using Pythagoras' relation. Solving such questions on measurements, is facilitated by the use of diagrams.

23. Using the knowledge on equi-angular triangles and the information given in the figure, find the value of x .



Expected Answer

12 (2)

$\frac{x}{6} = \frac{10}{5}$ or for a suitable equation or suitable ratio 1

2 marks

Observations and conclusions

The facility of this question which tests the knowledge on equiangular triangles is 25%. The principal reason for this is that candidates have not identified the corresponding sides of the equiangular triangles properly. It can be improved by providing more exercises on equiangular triangles of different shapes.

24. Write down an expression, in terms of n , for the sum of the first n terms of a geometric progression whose first term is 1 and common ratio is 2.

Expected Answer $2^n - 1$ or $\frac{1(2^n - 1)}{2 - 1}$ or $\frac{1(1 - 2^n)}{1 - 2}$ (2)

2 marks

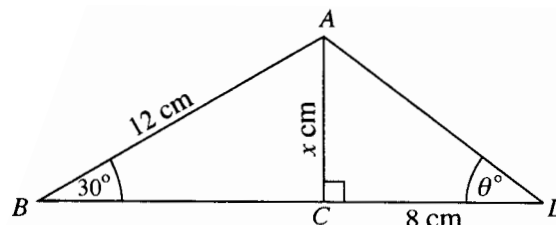
Observations and conclusions

The facility of this question based on geometric progressions under the theme Numbers is 15%. It is important to provide more practice on using the formula for the sum of a geometric progression, as well as using given data appropriately.

25. Using the information given in the figure and the fact that $\sin 30^\circ = \frac{1}{2}$, find

(i) the value of x

(ii) the value of $\tan \theta^\circ$.



Expected Answer

(i) 6 cm or 6 (1)

(ii) $\frac{6}{8}$ or $\frac{3}{4}$ or 0.75 or an equivalent value (1)

2 marks

Observations and conclusions

The facility of this question is 43%. The candidates have failed to apply the correct trigonometric ratios according to the given data, to obtain the correct answer for this question. One can reach the required achievement level by answering similar exercises constantly.

26. Considering the expansion of $(x - y)^3$, find the value of $2(24^3 - 3 \times 24^2 \times 4 + 3 \times 24 \times 4^2 - 4^3)$.

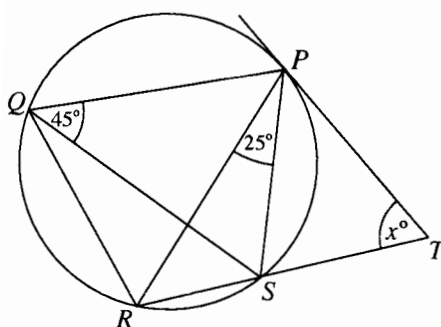
Expected Answer 16 000 (2)

$(24 - 4)^3$ or simplifying each term or 8 000 1 **2 marks**

Observations and conclusions

This question with 12% facility is the question in part A of paper I answered successfully by the least number of candidates. It is important to enhance the student's ability to solve such questions by paying more attention to finding the cube of an algebraic expression.

27. A tangent is drawn to the circle at P as shown in the figure. Using the given information, find the value of x .



Expected Answer

65 or 65° (2)

$\hat{PRS} = \hat{SPT} = 45^\circ$ or

$\hat{RQS} = 25^\circ$ or $\hat{PST} = 70^\circ$ 1

2 marks

Observations and conclusions

The facility of this question on Geometry is 22%. The candidates have failed to use the theorem correctly. They must be able to identify the geometric theorem related to the question and should be encouraged to do more exercises on such calculations.

28. The surface area of a solid sphere of radius 2 cm is A cm². The area of the curved surface of a solid cylinder of radius and height 2 cm each is B cm². Find the value of $\frac{A}{B}$. (The surface area of a solid sphere of radius r is $4\pi r^2$ and the area of the curved surface of a solid cylinder of radius r and height h is $2\pi rh$.)

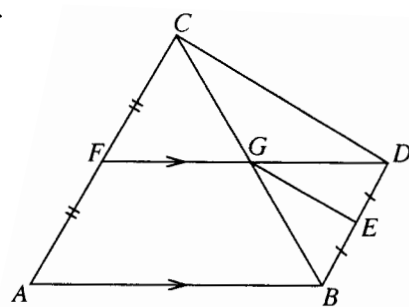
Expected Answer 2 (2)

$A = 4\pi 2^2$ or $B = 2\pi (2)(2)$ 1 **2 marks**

Observations and conclusions

The facility of the question is 31%. Although this is an easy question where the answer can be obtained by substituting values into the relevant formula, a majority of the candidates have failed to answer it correctly. Therefore they must learn how to use the knowledge gained from the lesson on measurements correctly and contextually.

29. In the figure, the area of triangle ABC is twice that of triangle BCD . Using the given information, find the ratio of the area of triangle CFG to the area of triangle BEG .



Expected Answer

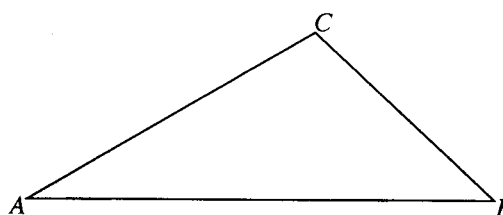
2 : 1 or $BEG \Delta : CFG \Delta = 1 : 2$ ②
 1 : 2 or $4(BEG \Delta) = BCD \Delta$ or
 $4(CFG \Delta) = ABC \Delta$ or
 For relationship between the areas of two suitable triangles. } 1

2 marks

Observations and conclusions

This question based on the areas of plane figures between two parallel lines has a facility of 32%. The main reason for this is that many candidates dislike geometry. Geometry enhances the logical skills of candidates. Therefore it is important to pay more attention to it.

30. In triangle ABC shown in the figure, draw a sketch of the construction lines required to locate the point D on AB such that $DB = DC$.



Expected Answer

Perpendicular bisector of BC 1
 Marking D 1

2 marks

Observations and conclusions

The facility of this question on geometrical loci is 26%. It is more productive to relate questions on loci to natural phenomena for students to practice applying the knowledge on loci to real situations.

Part B

1. Ananda had a small library. $\frac{1}{6}$ of the books in the library were children's story books and $\frac{1}{4}$ were literature books. Ananda donated these children's story books and literature books to the village school.

(i) Find what fraction of the total number of books was donated.

$$\frac{1}{4} + \frac{1}{6} = \frac{3+2}{12} = \frac{5}{12} \quad 1 + 1 + 1 \quad \text{3 Marks}$$

- The number of books donated was 150

(ii) Find the total number of books that were originally in the library.

$$150 \times \frac{12}{5} = 360 \quad 1 + 1 \quad \text{2 Marks}$$

- Of the remaining books, Ananda gave 60 to a neighbour

(iii) Find what fraction of the total number of books that were originally in the library was given to the neighbour.

$$\frac{60}{360} \quad \text{or} \quad \frac{1}{6} \quad \text{or an equivalent fraction} \quad \text{1 Mark}$$

- After giving to the neighbour, Ananda sold $\frac{3}{5}$ of the remaining books.

(iv) Find what fraction of the total number of books that were originally in the library was sold.

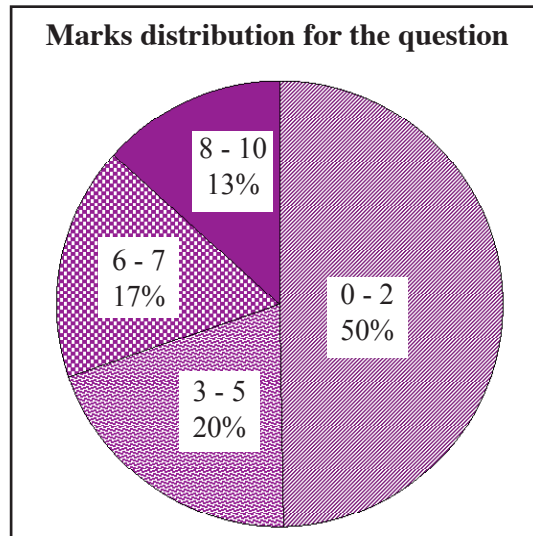
$$\text{Fraction donated and given to neighbour} = \frac{5}{12} + \frac{1}{6} = \frac{7}{12} \quad \dots\dots\dots 1$$

$$\therefore \text{Remaining fraction} = \frac{5}{12} \quad \dots\dots\dots 1$$

$$\therefore \text{Fraction sold} = \frac{5}{12} \times \frac{3}{5} \quad \dots\dots\dots 1$$

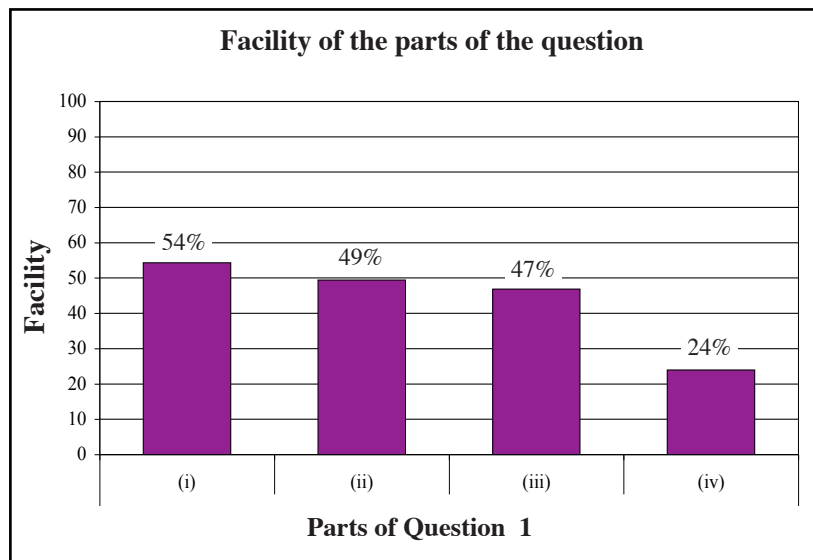
$$= \frac{1}{4} \quad \dots\dots\dots 1 \quad \text{4 Marks}$$

Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Numbers' carries 10 marks. Of the candidates who answered this question, about 50% have obtained marks in the interval 0 - 2, about 20% have obtained marks in the interval 3 - 5, about 17% have obtained marks in the interval 6 - 7, and about 13% have obtained marks in the interval 8 - 10.

70% of the candidates have obtained 5 marks or less for this question. Only 13% have obtained 8 marks or more.



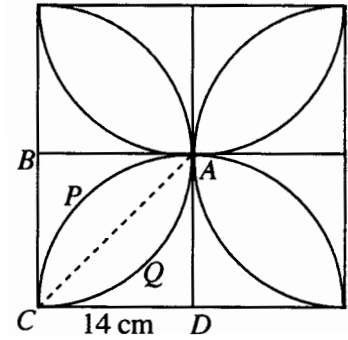
This question consists of 4 parts. The easiest part has been part (i) with a facility of 54%. The most difficult part has been part (iv) with a facility of 24%.

The first question of part B of mathematics Paper I is based on fractions under the theme 'Numbers'. Its facility is 33%.

Part (i) has a facility of 54% and it is given to evaluate the ability in adding fractions. The facility of part (ii) is 49%. Here the reverse calculation in obtaining the answer is at a satisfactory level. The facility of part (iii) is 47%. This part depends on the correct answer to part (ii), so its facility has decreased. The facility of part (iv) is 24%. The answer to this part depends on the correct answer to parts (i) and (ii). Therefore its facility too has decreased.

The candidates should enhance their skills in reading and understanding fraction problems as well as in simplifying fractions, to get the correct answer.

2. A wall decoration, consisting of four equal parts, is shown in the figure. One of the parts is a square $ABCD$, with each side 14 cm long, containing a petal-like shape $APCQ$. Here, $APCD$ and $AQCB$ are sectors with centres D and B respectively.



In the following calculations, take the value of π as $\frac{22}{7}$ wherever necessary.

- (i) Find the area of the triangle ABC .

$$\frac{1}{2} \times 14 \times 14 = 98 \text{ cm}^2 \quad 1 + 1$$

2 Marks

- (ii) Find the area of the sector $AQCB$.

$$\frac{1}{4} \times \frac{22}{7} \times 14 \times 14 = 154 \text{ cm}^2 \quad 1 + 1$$

2 Marks

- (iii) Find the area of the petal-like shape $APCQ$.

$$\text{Area of } AQC = 154 - 98 \quad \dots\dots\dots 1$$

$$\text{Area of } APCQ = 2 \times 56 = 112 \text{ cm}^2 \quad \dots\dots\dots 1$$

- (iv) Find the perimeter of the composite figure consisting of only the four petal-like shapes

$$2 \times \frac{22}{7} \times 14 \quad \dots\dots\dots 1$$

$$\text{Perimeter} = 2 \times (2 \times \frac{22}{7} \times 14) = 176 \text{ cm} \quad \dots\dots\dots 1$$

2 Marks

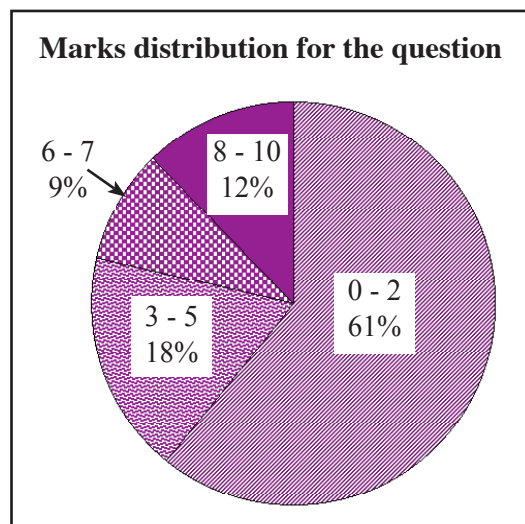
- (v) If it is needed to attach beads along the boundary of the composite figure considered in part (iv) above, starting from the point A , and lying 5.5 cm apart when measured along the boundary, find the required number of beads.

$$29$$

2 Marks

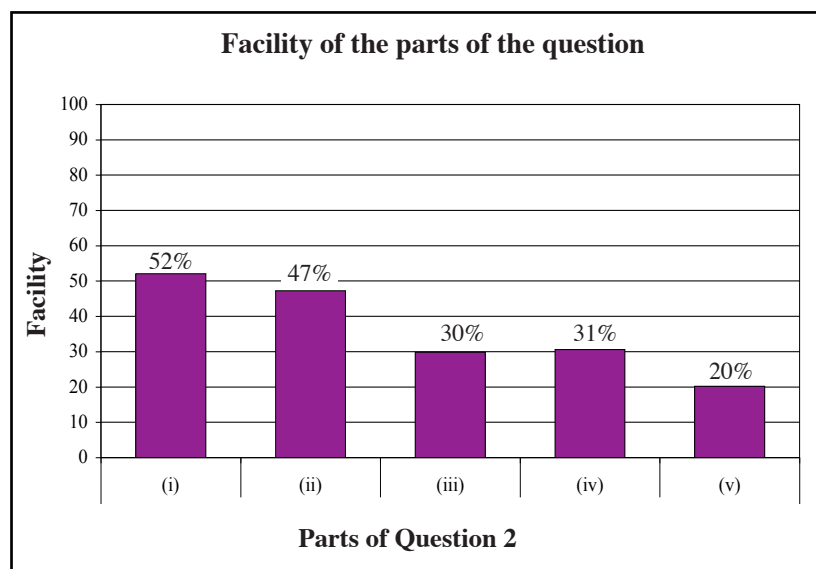
$$\frac{22}{5.5} \text{ or } \frac{176}{5.5} \text{ or } \frac{44}{5.5} \quad \dots\dots\dots 1$$

Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Measurements' carries 10 marks. Of the candidates who answered this question, about 61% have obtained marks in the interval 0 - 2, about 18% have obtained marks in the interval 3 - 5, about 9% have obtained marks in the interval 6 - 7, and about 12% have obtained marks in the interval 8 - 10.

79% of the candidates have obtained 5 marks or less for this question. Only 12% have obtained 8 marks or more.



This question consists of 5 parts. The easiest part has been part (i) with a facility of 52%. The most difficult part has been part (v) with a facility of 20%.

The facility of this question on perimeter and area under the theme 'Measurements' is 27%.

The facility of part (i) is 52%. This is due to the failure to identify the right triangle in the diagram, to find the area. The facility of part (ii) is 47%. This is due to the weakness in identifying the right sector in the diagram and due to the incorrect calculation of the area of the sector.

The facility of part (iii) is 30%. The accuracy of this answer depends on obtaining the correct answers to parts (i) and (ii). The area of the whole petal can be found by considering the area of half the petal. The facility of part (iv) is 31%. Lack of observation of the relationship between the shape of a flower petal and the circumference of a circle has caused this low facility level. The facility of part (v) is 20%. This is due to the lack of practice in using classroom knowledge in practical contexts.

Practice in analyzing diagrams and using mathematical concepts practically will help immensely in answering these types of questions. The ability to use formulae to calculate the area of a sector and the length of an arc needs to be improved.

3. An incomplete table containing information on the masses (in kg) of children brought to a clinic is shown below.

Class interval (mass)	5 – 10	10 – 15	15 – 20	20 – 25	25 – 30	30 – 35
Frequency (number of children)	2	5	8	8	6	3
Cumulative frequency	2	7	15	23	29	32

- (i) Complete the cumulative frequency row of the table. **1 mark for two correct values 2 Marks**
 (ii) Using the table, draw the cumulative frequency curve on the given coordinate plane.

Using the cumulative frequency curve, find the following:

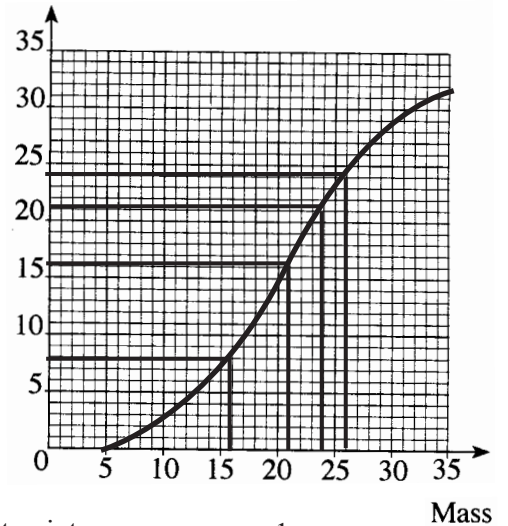
- (iii) median

$$\frac{32}{2} = 16^{\text{th}} \text{ one} \Rightarrow 21 \text{ kg} \quad \mathbf{1 \text{ Mark}}$$

- (iv) first quartile, third quartile and the interquartile range

$$\left. \begin{aligned} \frac{32}{4} = 8^{\text{th}} \text{ one} &\quad \Rightarrow 16 \text{ kg} \quad \dots\dots 1 \\ \frac{3}{4} \times 32 = 24^{\text{th}} \text{ one} &\Rightarrow 26 \text{ kg} \quad \dots\dots 1 \\ Q_3 - Q_1 = 26 - 16 = 10 \text{ kg} &\quad \dots\dots 1 \end{aligned} \right\} \mathbf{3 \text{ Marks}}$$

Cumulative frequency

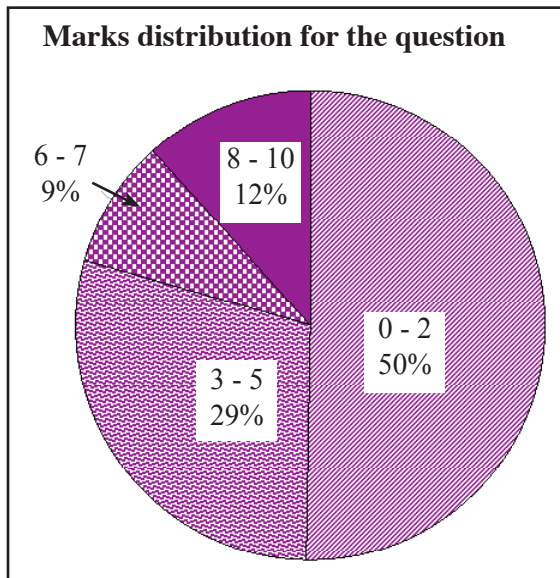


for 3 correct points 1
 smooth curve 1
 connecting curve to point 5 1 } **3 Marks**

- (v) the number of children whose mass is 24 kg or more.

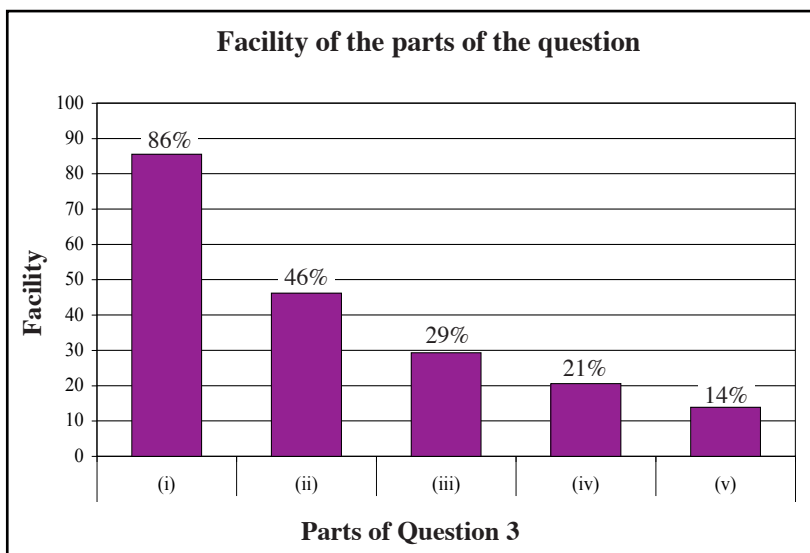
11 **1 Mark**

Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Statistics' carries 10 marks. Of the candidates who answered this question, about 50% have obtained marks in the interval 0 - 2, about 29% have obtained marks in the interval 3 - 5, about 9% have obtained marks in the interval 6 - 7, and about 12% have obtained marks in the interval 8 - 10.

79% of the candidates have obtained 5 marks or less for this question. Only 12% have obtained 8 marks or more.



This question consists of 5 parts. The easiest part has been part (i) with a facility of 86%. The most difficult part has been part (v) with a facility of 14%.

This question presented under the theme 'Statistics' has a facility of 34%.

Part (i) has a facility of 86%. Knowledge on finding the cumulative frequency is at a satisfactory level. The facility of part (ii) is 46%. Even though they have obtained the correct cumulative frequencies, they have made mistakes when drawing the cumulative frequency curve. Not marking the points, not drawing a smooth curve and not identifying the end points properly have caused this low facility level. The facility of part (iii) is 29%. This is due to not using the correct method in finding the median.

The facility of part (iv) is 21%. This might be due to not knowing the correct concept of quartiles. Only 14% of the candidates have answered part (v) correctly. The reason for it is the weakness in communicating the information in the graph.

Engaging in exercises on drawing cumulative frequency curves and answering questions based on the curves will help to overcome this weakness.

4. (a) The ratio of the income from apparel exports to the income from tea exports in Sri Lanka was 10 : 3 in 2006.

(i) In 2006, if the income from tea exports was 90 billion rupees, then find the income from apparel exports in billions of rupees.

$$90 \times \frac{10}{3} \dots\dots\dots 1$$

$$300 \dots\dots\dots 1$$

2 Marks

During the same year, the income from gem exports was 260 billion rupees less than the income from apparel exports.

(ii) Find, in the simplest form, the ratio of the export incomes from tea to apparels to gems.

$$\text{Income from gem export} = 300 - 260 = \text{Rs. } 40 \text{ billion} \dots\dots\dots 1$$

$$90 : 300 : 40 \dots\dots\dots 1$$

$$9 : 30 : 4 \dots\dots\dots 1$$

3 Marks

(b) The food stock at a camp is sufficient for 15 days for the 60 soldiers stationed there. After 3 days, 20 more soldiers join the camp.

(i) Find for how many days the remaining stock of food is sufficient for the 80 soldiers.

$$\text{Food stock at the beginning} = 60 \times 15 = 900 \dots\dots\dots 1$$

$$\begin{aligned} \text{Remaining food} &= 900 - 180 \\ &= 720 \text{ or } 12 \times 60 \dots\dots\dots 1 \end{aligned}$$

$$\text{Number of days sufficient for } 80 = \frac{720}{80} = 9 \dots\dots\dots 1$$

3 Marks

or

$$\text{Number of days sufficient for } 80 = \frac{12 \times 60}{80} \dots\dots\dots 2$$

$$= 9 \dots\dots\dots 1$$

3 Marks

After 2 more days, the camp receives a stock of food sufficient for 10 soldiers for 16 days.

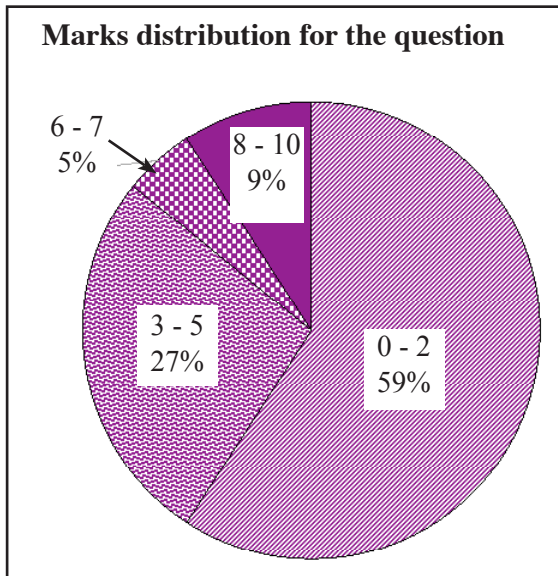
(ii) Find for how many days the total stock of food in the camp at present would be sufficient for the 80 soldiers.

$$\begin{aligned} \text{Amount of food stock after 2 more days} &= 80 \times 7 + 10 \times 16 \\ &= 720 \dots\dots\dots 1 \end{aligned}$$

$$\begin{aligned} \text{Number of days sufficient for } 80 &= \frac{720}{80} \\ &= 9 \dots\dots\dots 1 \end{aligned}$$

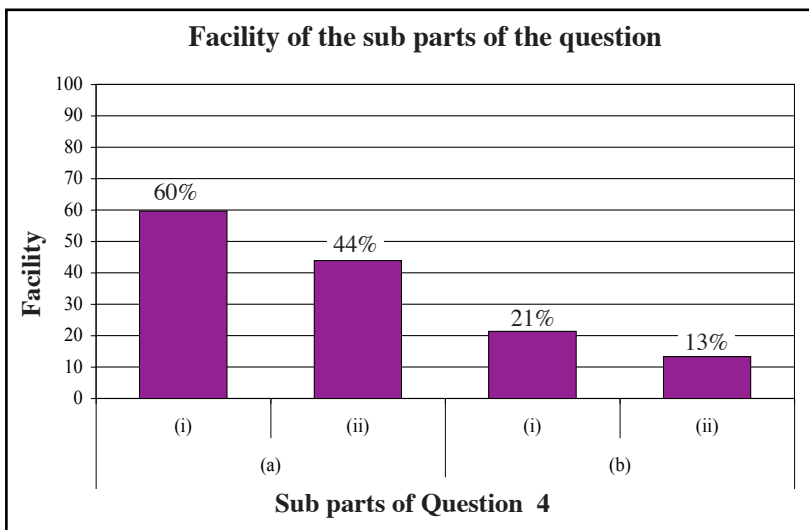
2 Marks

Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Numbers' carries 10 marks. Of the candidates who answered this question, about 59% have obtained marks in the interval 0 - 2, about 27% have obtained marks in the interval 3 - 5, about 5% have obtained marks in the interval 6 - 7, and about 9% have obtained marks in the interval 8 - 10.

86% of the candidates have obtained 5 marks or less for this question. Only 9% have obtained 8 marks or more.



This question consists of 4 sub parts. The easiest sub part has been sub part (a)(i) with a facility of 60%. The most difficult sub part has been sub part (b)(ii) with a facility of 13%.

This question under the theme 'Numbers' and about ratios and proportions has a facility of 26%.

Part (a)(i) has a facility of 60%. This can be easily answered by using the unitary method. It is at a satisfactory level. The facility of part (a)(ii) is 44%. Not calculating the export income using the given data and lack of competency in manipulating the relationships between the terms of the ratios have caused this decrease.

The facility of sub part (b)(i) is 21% and that of sub part (b)(ii) is 13%. These parts are given to test the knowledge on inverse proportions. Not writing the correct proportions when using inverse proportions has caused a low facility level.

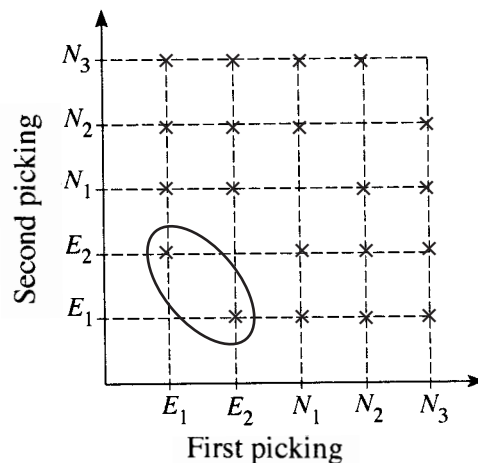
To answer this type of question, the candidate's language skills and communication skills need to be at a high level. And they should also engage in doing relevant exercises.

5. In a box, there are 5 bottles of fruit juice of the same type and size. Of them, 2 are expired and the other 3 are nearly expired. A lab assistant picks a bottle from the box randomly and **without replacement**, he picks another bottle randomly.

An incomplete grid prepared to represent the sample space relevant to this random experiment is given in the figure. Here E_1 and E_2 denote the expired bottles and N_1, N_2 and N_3 denote the nearly expired bottles.

- (i) Indicate the sample space in the grid using the mark 'x'.

For marking the sample space **2 Marks**



- (ii) In the grid, enclose the event of “the two bottles picked being expired”, and find its probability.

For marking in the grid 1

$\frac{2}{20}$ or equivalent fraction 2

(for numerator of $\frac{2}{20}$ 1
for denominator of $\frac{2}{20}$ 1)

3 Marks

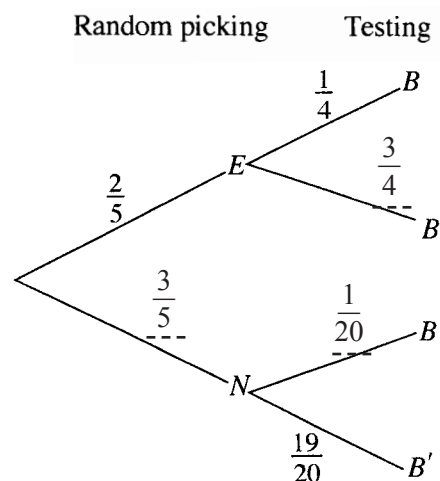
The assistant replaces both bottles in the box. After that, a researcher picks a bottle randomly from the same box and tests the juice in it for the presence of a certain bacteria.

An incomplete tree diagram relevant to this random experiment is shown in the figure below, where E denotes the bottle being expired, N denotes the bottle being nearly expired, B denotes the presence of the bacteria and B' denotes the absence of the bacteria.

- (iii) Write down the relevant probabilities in the tree diagram.

For writing correct values in the tree diagram 1 + 1 + 1

3 Marks



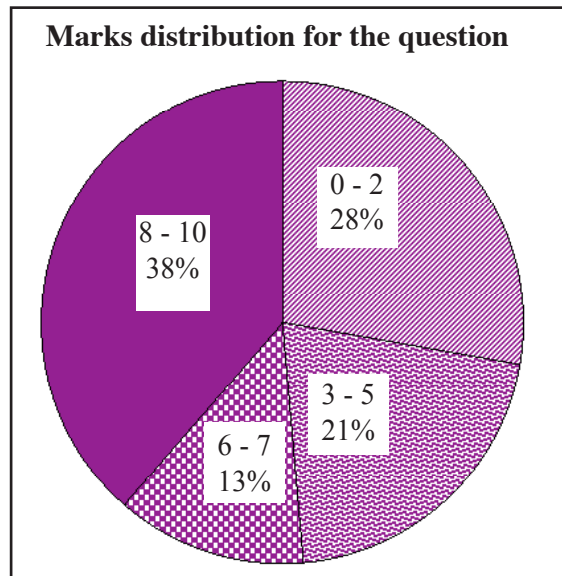
- (iv) Find the probability that the juice in the bottle picked contains the bacteria.

$\left(\frac{2}{5} \times \frac{1}{4}\right) + \left(\frac{3}{5} \times \frac{1}{20}\right)$ 1

$\frac{13}{100}$ 1

2 Marks

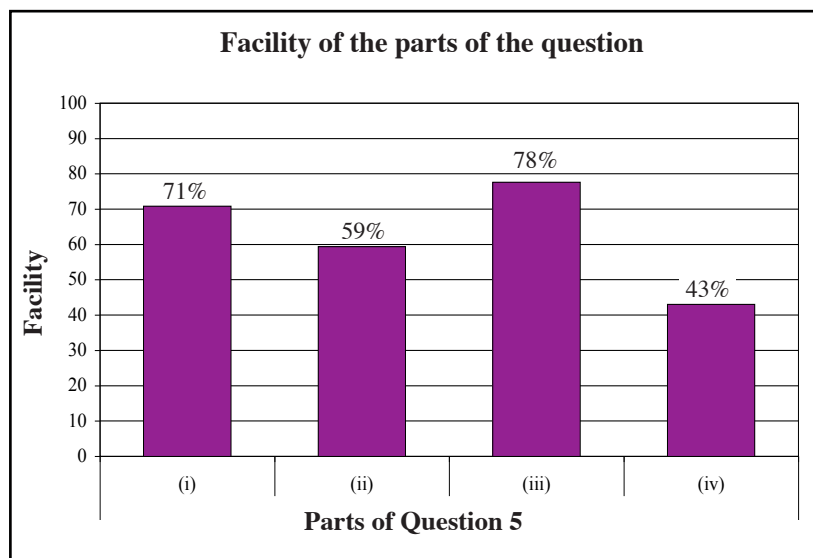
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Sets and Probability' carries 10 marks. Of the candidates who answered this question,

about 28% have obtained marks in the interval 0 - 2, about 21% have obtained marks in the interval 3 - 5, about 13% have obtained marks in the interval 6 - 7, and about 38% have obtained marks in the interval 8 - 10.

49% of the candidates have obtained 5 marks or less for this question. Only 38% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (iii) with a facility of 78%. The most difficult part has been part (iv) with a facility of 43%.

The facility of this question under the theme 'Probability' is 53%. This is the question in part B of Paper I with the highest facility.

The facility of part (i) is 71%. The ability in marking the sample space in the grid is at a satisfactory level. The facility of part (ii) is 59%. Failure to identify and mark the relevant event on the grid as well as the inability to calculate the probability have caused the low facility. The facility of part (iii) is 78%. Most candidates have marked the relevant probability on the given tree diagram correctly. This is the reason for the satisfactory high facility recorded here. The facility of part (iv) is 43%. Unfamiliarity in using the tree diagram to reach the expected answer for the question has caused this drop in facility.

When the sample space of a random experiment is represented in a grid, it should be correctly identified whether the experiment is done with replacement or not. It is necessary to mark the outcomes of the experiment in the grid correctly. Furthermore how the probability is calculated should be shown. Competency in the multiplication of fractions and the addition of fractions help to overcome these weaknesses.

2.2 Paper II

2.2.1 Structure of Paper II

Time : Two hours and thirty minutes, Marks : 50

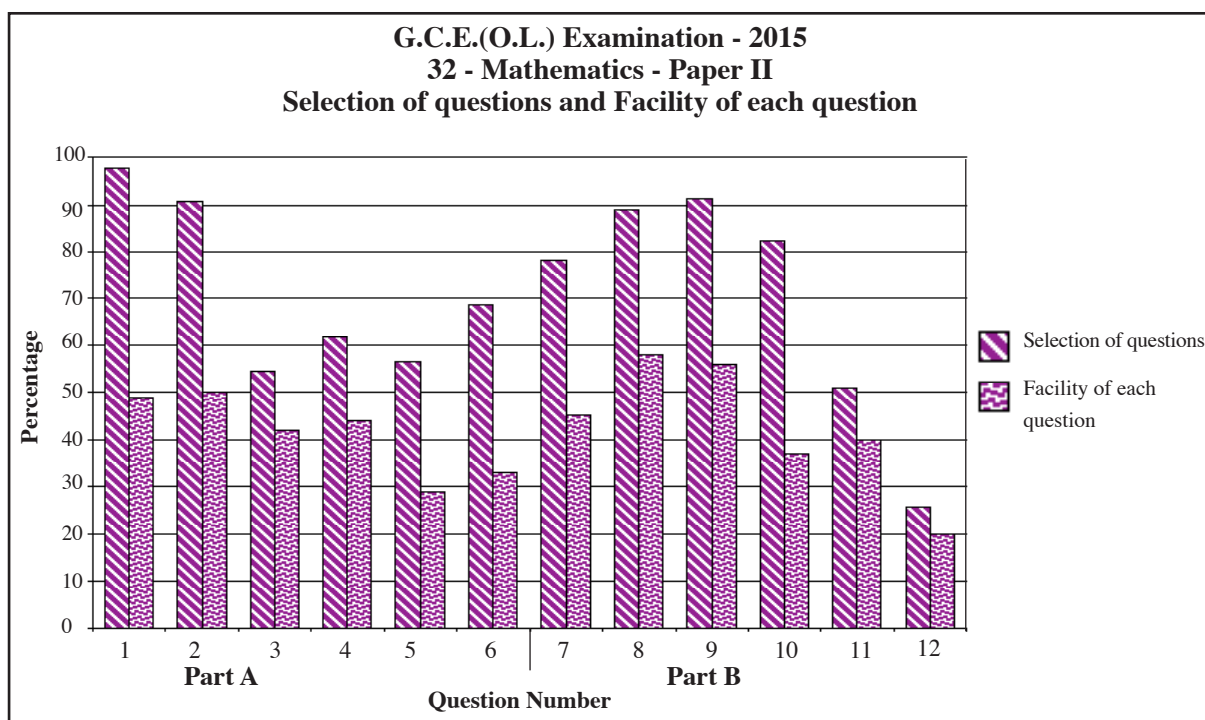
This question paper consists of 12 structured essay type questions based on the six themes Numbers, Measurements, Algebra, Geometry, Statistics, Sets and Probability. It contains two parts, Part **A** and Part **B**. It is expected that answers will be provided for 5 of the 6 questions in Part **A** and 5 of the 6 questions in Part **B**, totaling 10 questions.

10 marks are allocated for each question totaling 100 marks.

Final marks for Paper II = $100 \div 2 = 50$

2.2.2. Overall observations on the answers to Paper II

Candidates are expected to answer five questions selected from Part A which consists of questions number 1 to 6, and another five questions selected from Part B which consists of questions number 7 to 12. Total number of questions to be answered is 10.



Graph 7.I (Based on the information gathered from the forms RD/16/02/OL and RD/16/04/OL)

Part A

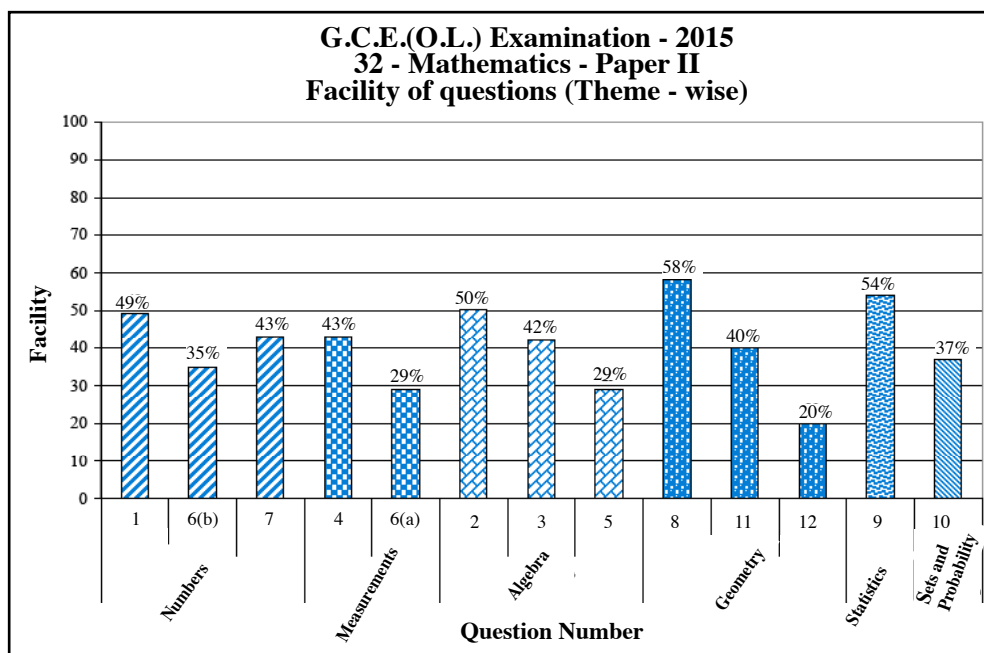
According to this graph, 98% of the candidates have selected question number 1 from the 6 questions in Part A of Mathematics Paper II. Its facility is 49%. This is the question from this part with the highest selection. It comes under the theme 'Numbers' and is based on the subject matter percentages, shares, dividends and compound interest. Question number 3 has the least selection and it is 55%. The facility of question number 3 is 42%. It is based on solving equations using the method of completing the square, under the theme 'Algebra'. Of the 6 questions in Part A, question number 2 has the highest facility and question number 5 has the lowest facility. The facilities of these two questions are 50% and 29% respectively. Question 2 is based on the graph of a quadratic function and question 5 is based on algebraic expressions, and constructing simultaneous equations and solving them. Hence the hardest question and the easiest one in Part A are based on the theme 'Algebra'.

Part B

The questions with the highest selection and the lowest selection in Part B of Mathematics Paper II are questions number 9 and number 12 respectively. Their percentages of selection are 91% and 26% respectively. Of the 6 questions in Part B, the questions with the highest facility and the lowest facility are questions number 8 and 12 respectively. Their facilities are 58% and 20% respectively. Question 9 is on Statistics. It has earned the highest preference in selection. But candidates have gained more marks by answering question number 8 which is based on constructions. Question number 12 which is based on Geometry has the lowest selection. Most of the candidates who have selected question 12 have failed to obtain high marks for it.

When Mathematics Part II is considered overall, question 8 has been the easiest question and question 12 the most difficult. Facility level of 50% or above has been achieved for question numbers 2, 8 and 9 only.

2.2.3. Observations (theme - wise) based on the answers to Paper II

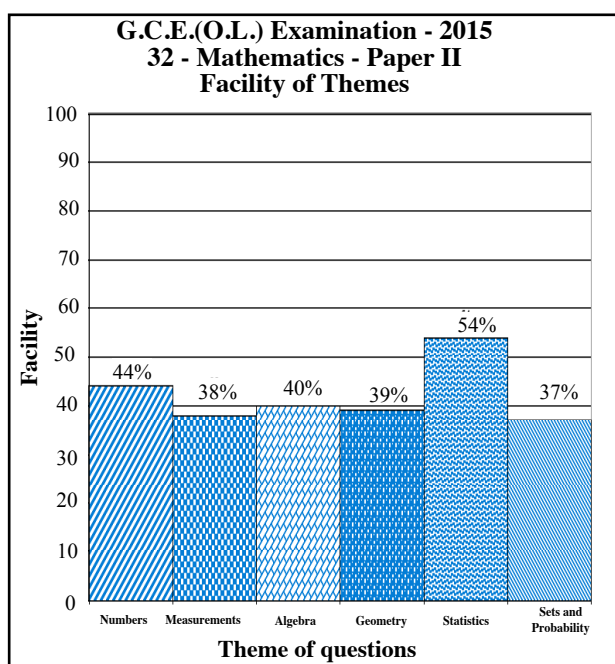


Graph 7.II

Theme	Question of Part A	Question of Part B
1. Numbers	1, 6 (b)	7
2. Measurements	4, 6 (a)	-
3. Algebra	2, 3, 5	-
4. Geometry	-	8, 11, 12
5. Statistics	-	9
6. Sets and Probability	-	10

Graph 8

Of the 12 questions, question number 8 is the one with the highest facility. It comes under the theme 'Geometry'. Question number 12 has the least facility and it also comes under the theme 'Geometry'.



Graph 7.III

The 12 questions in Paper II have been sorted out according to themes and their facilities have been calculated and represented in graph 7. III. According to the graph, the facility of the theme 'Statistics' is the highest and the facility of the theme 'Measurements' is the lowest. Their facilities are 54% and 38% respectively. Only one question from the theme 'Statistics' and one and a half questions from the theme 'Measurements' have been included in Paper II. The themes 'Algebra' and 'Geometry', occupying the largest share of the question paper are of facilities 40% and 39% respectively. The theme 'Geometry' has recorded a higher facility level than the theme 'Measurements' for this year.

Although the facility of each theme has increased, except for the theme 'Statistics' all the others have recorded facilities of less than 50%.

2.2.4 Expected answers for Paper II, Marking scheme, Observations, Conclusions and Suggestions on the answers.

Observations on the answers to Paper II are based on Graphs 3, 4, 5.I, 5.II, 7.I, 7.II and 7.III. The part of the graph relevant to the question is provided with the observations and conclusions of each question.

Part A

Objectives of Question 1

Competency 5: Carries out transactions successful in the modern commercial world using percentages.

When the amount paid for a quarter as assessment tax and the annual rates percentage of the property are given,

- (i) finds the assessment tax.
- (ii) finds the annual value of the property.

When the rent amount for a month is given and the advance payment is stated in terms of the number of months of rent,

- (iii) finds the advance payment.

When it is given that this advance payment is invested in a company of which the nominal value of a share, market value of a share and annual dividends are known,

- (iv) finds the nominal value of the shares and the dividend income received at the end of the year.
- (v) states with reasons whether in agreement or not with the given statement related to the annual dividend income and a certain percentage of the annual rent.

1. Palitha pays Rs 750 per quarter as assessment tax for a building he owns. The annual assessment tax charged for the building is 15% of its annual value.

- (i) Find the assessment tax Palitha pays per year.
- (ii) Find the annual value of the building.

Palitha rents out this building for Rs 20 000 a month. He obtains the rent for 6 months as an advance payment.

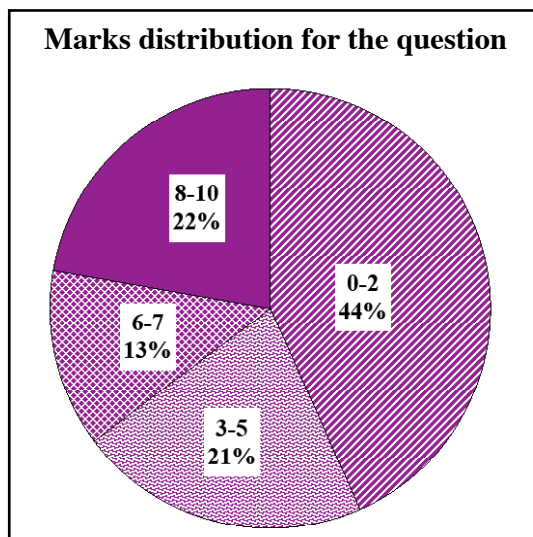
- (iii) Find the advance payment Palitha obtains.

He invests this advance payment to buy shares of a company that pays annual dividends of 25% for its shares. A share of this company of nominal value Rs 100 is sold at Rs 120.

- (iv) Find the nominal value of the shares Palitha buys and then find the dividend income he receives at the end of a year.
- (v) State, with reasons, whether you agree or not with the statement, “The annual dividend income Palitha receives from investing in the company is more than 10% of the annual rent he receives by renting out the building”.

Question Number		Answer	Marks		Other
1.	(i)	750×4 Rs. 3000	1	①	
	(ii)	$\frac{3000 \times 100}{15}$ ∴ 20 000	1 1	②	Give this mark if the answer from part (i) has been used.
	(iii)	$20\ 000 \times 6$ Rs. 120 000	1	①	
	(iv)	Nominal value of the shares = $\frac{120000}{120} \times 100$ = Rs. 100 000 Dividend income = $100\ 000 \times \frac{25}{100}$ = Rs. 25 000	1 1 1 1	④	
	(v)	Value of 10% of the annual rent = $(20\ 000 \times 12) \times \frac{10}{100}$ = Rs. 24 000 Since $25\ 000 > 24\ 000$, I agree with the statement	1 1	②	10

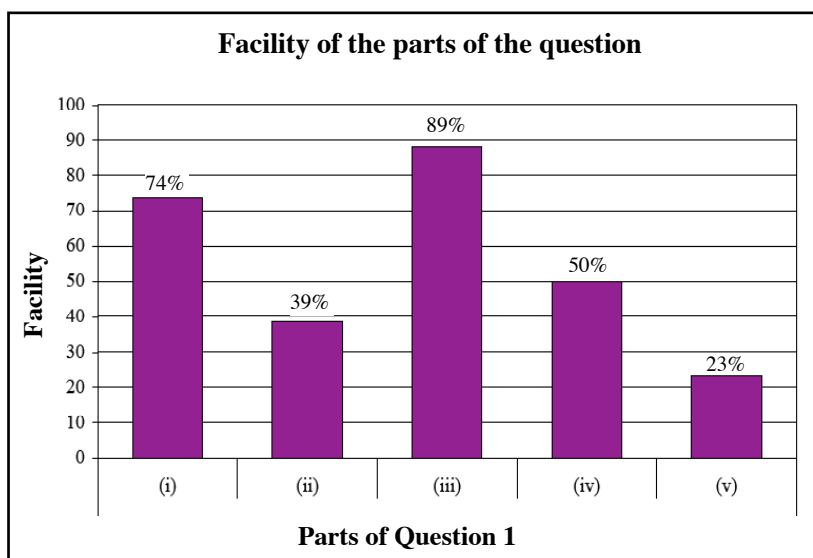
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Numbers' carries 10 marks. 98% of the candidates have selected it. Of these candidates,

about 44% have obtained marks in the interval 0 - 2, about 21% have obtained marks in the interval 3 - 5, about 13% have obtained marks in the interval 6 - 7, and about 22% have obtained marks in the interval 8 - 10.

65% of the candidates have obtained 5 marks or less for this question. Only 22% have obtained 8 marks or more.



This question consists of 5 parts. The easiest part has been part (iii) with a facility of 89%. The most difficult part has been part (v) with a facility of 23%. Overall facility of the question is 49%.

98% of the candidates have selected this question to answer. It consists of 5 parts related to assessment tax and the share market under the theme 'Numbers'.

Part (i) is an easy part on finding the assessment tax and it records a high facility value of 74%.

Part (ii) records a low facility of 39% with a sharp decline due to the candidates' failure in applying the mathematical relationship to find the annual value of the building correctly. Part (iii) which asks to find the rent for 6 months when the monthly rent is given, is very simple and its facility is 89%. This is the highest facility of any part of this question.

Part (iv) which requires candidates to calculate the dividend income from the shares, has been difficult due to their tendency to calculate it as a percentage of the value obtained in part (iii) without using the suitable method.

Part (v) which is given to test the higher order skills of problem solving and providing reasons has secured the lowest facility of 23%. It is necessary to engage students in doing exercises to consolidate the ability to use the correct methodology in such questions.

Objectives of Question 2

Competency 20: Easily communicates the mutual relationships between two variables by exploring various methods.

Expected Learning Outcomes:

When an incomplete table is given to draw the graph of a function of the form of $y = -x^2 + ax + b$; $a, b \in \mathbb{Z}$,

- (i) finds the value of y corresponding to the given x value.
- (ii) draws the graph using the table provided and according to the given scale.

Using the graph,

- (iii) writes down the range of values of x for which $y \geq c$; $c \in \mathbb{Z}^-$.
- (iv) writes the co - ordinates of the maximum point and then writes the given function in the form $y = k - (x + h)^2$; $k, h, \in \mathbb{Z}$.
- (v) given that $d = \sqrt{e}$; $e \in \mathbb{Z}^+$ is a root of the equation $x^2 - ax - b = 0$, finds an approximate value for \sqrt{e} to the first decimal place.

2. An incomplete table prepared to draw the graph of the function $y = -x^2 + 4x - 1$ is given below.

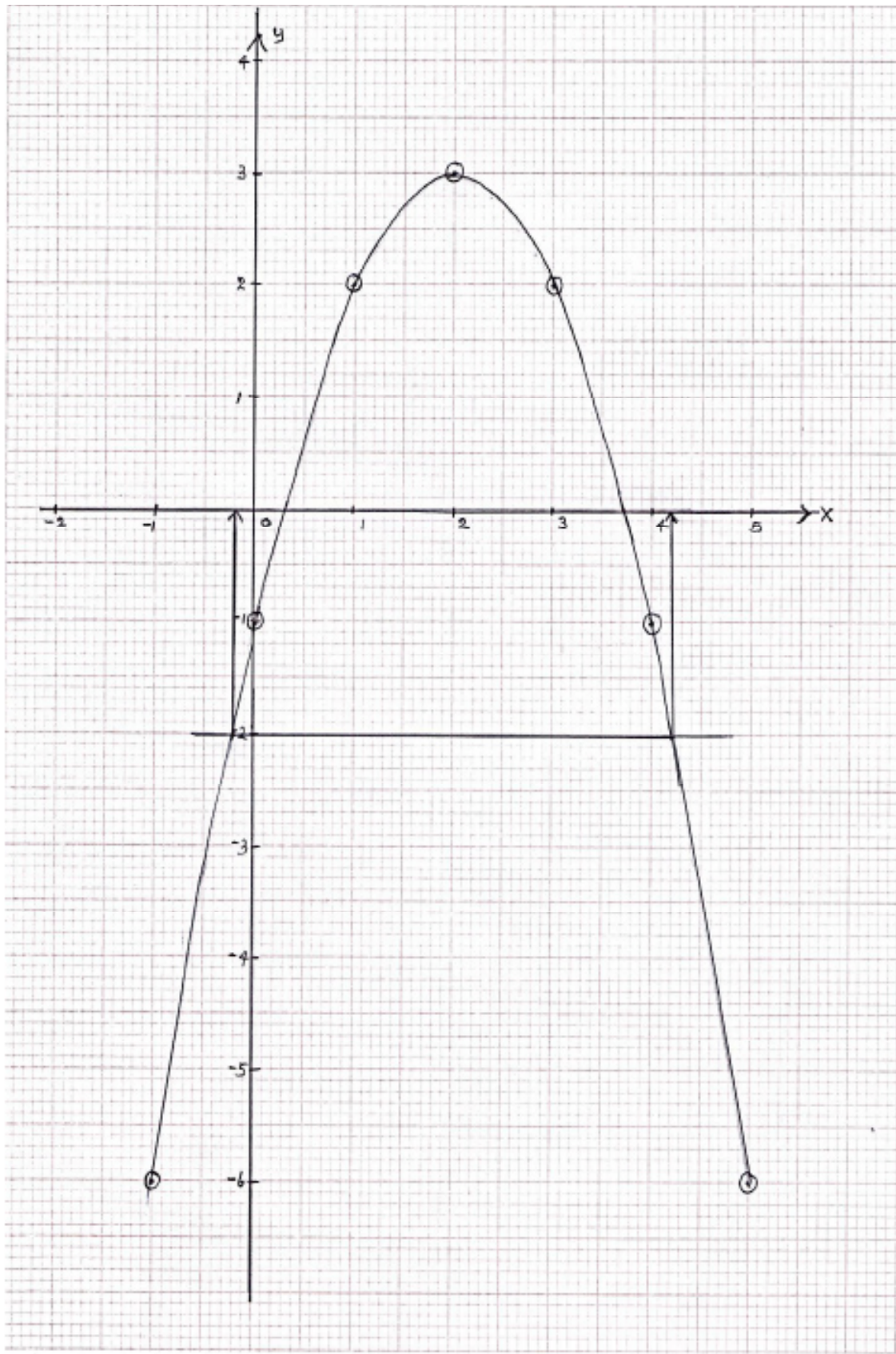
x	-1	0	1	2	3	4	5
y	-6	-1	2		2	-1	-6

- (i) Find the value of y when $x = 2$.
- (ii) Using the scale of 10 small divisions as one unit along the x -axis and along the y -axis, draw the graph of the above function on a graph paper.

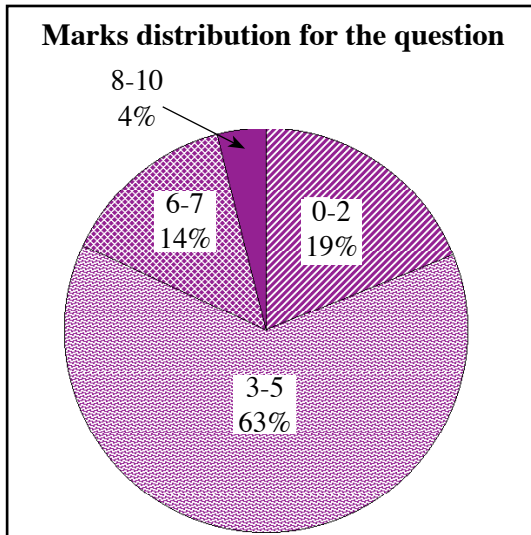
Answer the following questions **using the graph**.

- (iii) Write down the range of values of x for which $y \geq -2$.
- (iv) Write down the coordinates of the maximum point of the graph and thereby write down the given function in the form $y = k - (x - h)^2$, where k and h are constants.
- (v) Given that $2 - \sqrt{3}$ is a root of the equation $x^2 - 4x + 1 = 0$, find an approximate value for $\sqrt{3}$ to the first decimal place.

Question Number		Answer	Marks		Other
2.	(i)	3	1	①	
	(ii)	Correct axes - 1 Marking at least 6 points correctly - 1 Smooth curve - 1		③	
	(iii)	$-0.2 \leq x \leq 4.2$ (± 0.1) or From -0.2 to 4.2 (± 0.1)	1	①	Identifying the two points - 1
	(iv)	(2, 3) $y = 3 - (x - 2)^2$	1 1	②	
	(v)	$y = 0$ when $x = 0.3$ or $x = 3.7$ $2 - \sqrt{3} = 0.3$ (± 0.1) $\therefore 2 - 0.3 = \sqrt{3}$ $\sqrt{3} = 1.7$ (± 0.1)	1 1	②	Even if $2 - \sqrt{3} = 3.7$ has been written, disregard it and give 1 mark for $2 - \sqrt{3} = 0.3$
					10



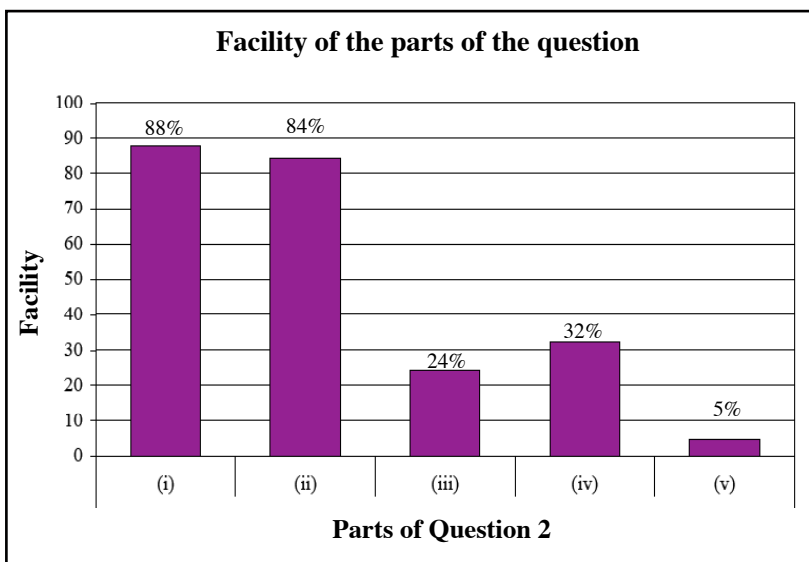
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Algebra' carries 10 marks. 91% of the candidates have selected it. Of these candidates,

about 19% have obtained marks in the interval 0 - 2, about 63% have obtained marks in the interval 3 - 5, about 14% have obtained marks in the interval 6 - 7, and about 4% have obtained marks in the interval 8 - 10.

82% of the candidates have obtained 5 marks or less for this question. Only 4% have obtained 8 marks or more.



This question consists of 5 parts. The easiest part has been part (i) with a facility of 88%. The most difficult part has been part (v) with a facility of 5%. Overall facility of the question is 50%.

91% of the candidates have selected this question which is related to the theme 'Algebra' and tests the knowledge on graphs. Even though this is one of the most popular questions among the candidates, the percentage of candidates who obtained marks in the range 0 - 5 is 82%.

The facilities of parts (i) and (ii) are 88% and 84% respectively and the facility of each of the remaining three parts takes a value less than 35%. This question tests the ability in drawing a graph using the given table of values and the ability in answering questions on the graph.

Observing the accurately drawn graph, the coordinates of the maximum point can be written easily. By using these coordinates the equation of the function can be written. This method should be well mastered to find the answer easily. The candidates should be trained to answer these types of questions with understanding rather than mechanically.

In part (v), most of the candidates had tried to get the answer by solving the quadratic equation. This is not expected for questions of this type. Candidates should follow the given instructions and find the answer by using the graph only.

Objectives of Question 3

Competency 17: Manipulates the methods of solving equations to fulfill the needs of day to day life.

Expected Learning Outcomes:

When a composite figure of a square and a rectangle is given, along with the lengths of the sides of the rectangle and square, expressed in algebraic terms,

- (i) shows that the length of the side named is a given algebraic expression.
- (ii) constructs a quadratic equation using the given relationship on the ratios of the sides.
- (iii) solves the quadratic equation by using the formulae or any other method and shows that the solution is a given expression,
- (iv) shows that one of the solutions of the equation is not a suitable expression for a named length.

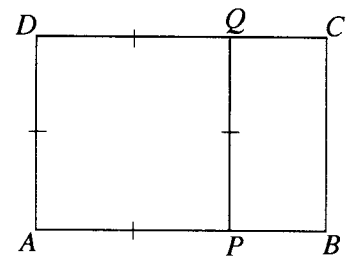
3. In the rectangle $ABCD$ given in the figure, $AB = 3x + 2$ cm and $AD = x + 3$ cm. It is given that $APQD$ is a square.

(i) Show that $PB = 2x - 1$ cm.

(ii) It is given that $\frac{AB}{AD} = \frac{PQ}{PB}$. Show that $5x^2 - 5x - 11 = 0$.

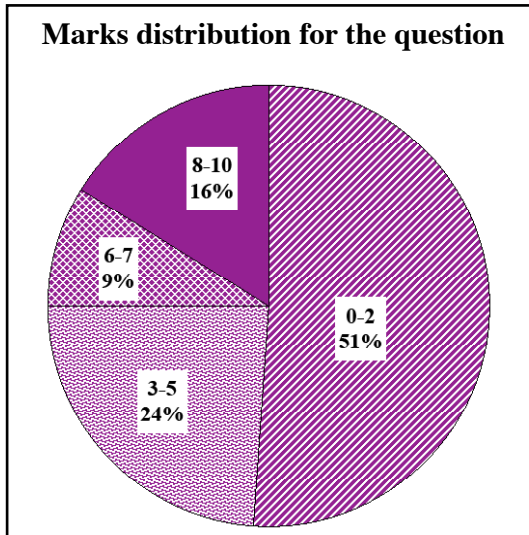
(iii) Using the formula or by any other method, show that $x = \frac{5 \pm 7\sqrt{5}}{10}$.

(iv) By substituting the solution $x = \frac{5 - 7\sqrt{5}}{10}$ in the expression in part (i) above for the length of PB , show that this solution is **not** suitable.



Question Number		Answer	Marks		Other
3.	(i)	$PB = (3x + 2) - (x + 3)$ $= (2x - 1)$	1	①	
	(ii)	$\frac{(3x + 2)}{(x + 3)} = \frac{(x + 3)}{(2x - 1)}$ $(3x + 2)(2x - 1) = (x + 3)^2$ $6x^2 - 3x + 4x - 2 = x^2 + 6x + 9$ $5x^2 - 5x - 11 = 0$	1 1 2	④	<p>If one side is correct, give 1 mark</p> <p>If both sides are correct and $5x^2 - 5x - 11 = 0$ is written, give 2 marks.</p>
	(iii)	$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 5 \times (-11)}}{2 \times 5}$ $= \frac{5 \pm \sqrt{245}}{10}$ $= \frac{5 \pm \sqrt{49 \times 5}}{10}$ $= \frac{5 \pm 7\sqrt{5}}{10}$	1 1 1	③	$5x^2 - 5x - 11 = 0$ $\left(x - \frac{1}{2}\right)^2 = \frac{49}{20}$ $x - \frac{1}{2} = \pm \frac{7}{2\sqrt{5}}$ $x = \frac{1}{2} \pm \frac{7}{2\sqrt{5}}$ $= \frac{5}{10} \pm \frac{7\sqrt{5}}{10}$ $= \frac{5 \pm 7\sqrt{5}}{10}$
	(iv)	$2 \left(\frac{5 - 7\sqrt{5}}{10} \right) - 1$ $= \frac{5}{5} - \frac{7\sqrt{5}}{5} - 1$ $= -\frac{7\sqrt{5}}{5}$ <p>Since $-\frac{7\sqrt{5}}{5} < 0$, this solution is not suitable for the length of PB</p>	1 1	②	for substitution
				⑩	

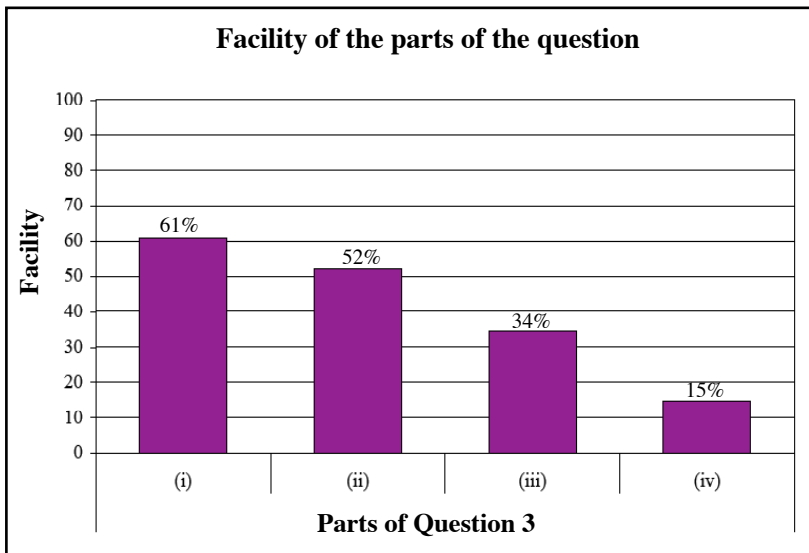
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Algebra' carries 10 marks. 55% of the candidates have selected it. Of these candidates,

about 51% have obtained marks in the interval 0 - 2,
about 24% have obtained marks in the interval 3 - 5,
about 9% have obtained marks in the interval 6 - 7,
and about 16% have obtained marks in the interval 8 - 10.

75% of the candidates have obtained 5 marks or less for this question. Only 16% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (i) with a facility of 61%. The most difficult part has been part (iv) with a facility of 15%. Overall facility of the question is 42%.

55% of the candidates have selected this question to answer. This question which is related to the theme 'Algebra' tests the ability in solving quadratic equations. It has been presented in a way which deviates from the familiar pattern. Through this question, it is expected to test communication skills and the ability in seeing connections.

The facility of part (i) related to the subtraction of an algebraic expression from a given different algebraic expression is 61%. It is necessary to train the candidates to get the answer by writing the expression to be subtracted within brackets correctly and then carrying out the simplification. Furthermore, by exposing the candidates to more questions related to subtracting algebraic expressions, this competency can be enhanced.

Part (ii) in which it is expected to construct a quadratic equation by using the given data has a facility of 52%. The equation has to be constructed by correctly substituting expressions into the relationship between the lengths of the sides and simplifying.

It is expected to test the skill of solving a quadratic equation by using the formula in part (iii). If the candidates had followed the instructions and done this, they could have easily obtained the answer.

It is evident from the low facility of 15% of part (iv), that candidates have faced difficulty in answering this part which is based on seeing connections. Students need to be taught to answer questions by following instructions. This can be done with suitable exercises and proper guidance.

Objectives of Question 4

Competency 13 : Uses scale drawings in practical situations by exploring various methods.

Expected Learning Outcomes:

When a rough sketch of a horizontal ground, the bearings of three points on the horizontal ground and the distance between two of these points are given,

- (i) calculates the magnitudes of the angles named.
- (ii) shows that the magnitude of the angle named is 90° .
- (iii) calculates the distance between two places named by using trigonometric tables.

When the location of a place which lies on the line joining two places is given,

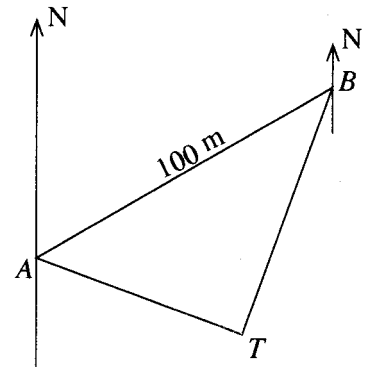
- (iv) calculates the magnitude of the angle named by using trigonometric tables.

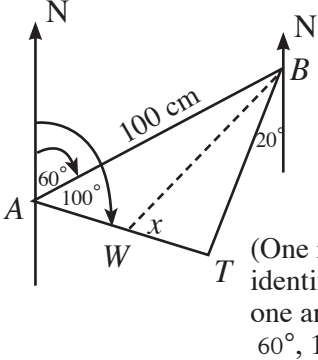
4. A rough sketch of a horizontal ground is shown in the figure. The bearing of the tree T from location A is 110° . Location B is at a distance of 100 metres from A , on a bearing of 060° . Moreover, the bearing of T from B is 200° .

- (i) Copy the figure and calculate the magnitudes of \hat{BAT} and \hat{ABT} .
- (ii) Show that $\hat{ATB} = 90^\circ$.
- (iii) Using the trigonometric tables, calculate the distance from B to T .

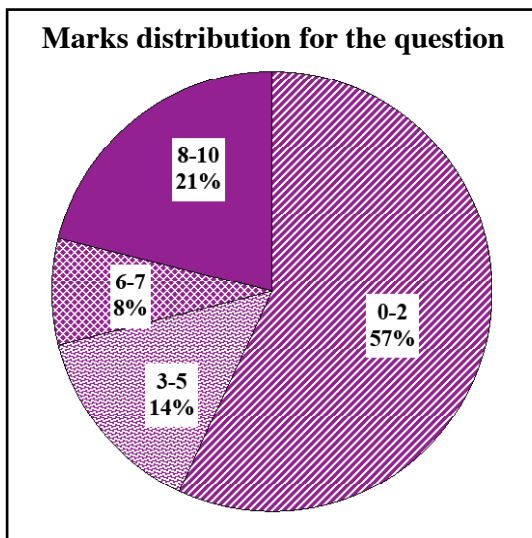
The well W is located on the line AT such that $WT = 40$ m.

- (iv) Using the trigonometric tables, calculate the magnitude of \hat{BWT} .



Question Number	Answer	Marks	Other
4.	 <p>(One mark for identifying any one angle correctly 60°, 110°, 200°, 20°)</p>		
(i)	$\hat{BAT} = 110^\circ - 60^\circ = 50^\circ$ $\hat{ABT} = 60^\circ - 20^\circ = 40^\circ$	1 1 1 (3)	
(ii)	$\hat{ATB} = 180^\circ - (50^\circ + 60^\circ) = 90^\circ$	1 (1)	$\hat{ATB} = 70^\circ + 20^\circ = 90^\circ$ (1)
(iii)	$\sin 50^\circ = \frac{BT}{100}$ $100 \times 0.7660 = BT$ $BT = 76.6 \text{ m}$	1 1 1 (3)	$\cos 40^\circ = \frac{BT}{100}$ $100 \times 0.7660 = BT$ $BT = 76.6 \text{ m}$ (3)
(iv)	$\tan \hat{BWT} = \frac{76.6}{40}$ $\tan \hat{BWT} = 1.915$ $\therefore \hat{BWT} = 62^\circ 26'$	1 1 1 (3)	Writing the value of BT from (iii) above and dividing by 40. (10)

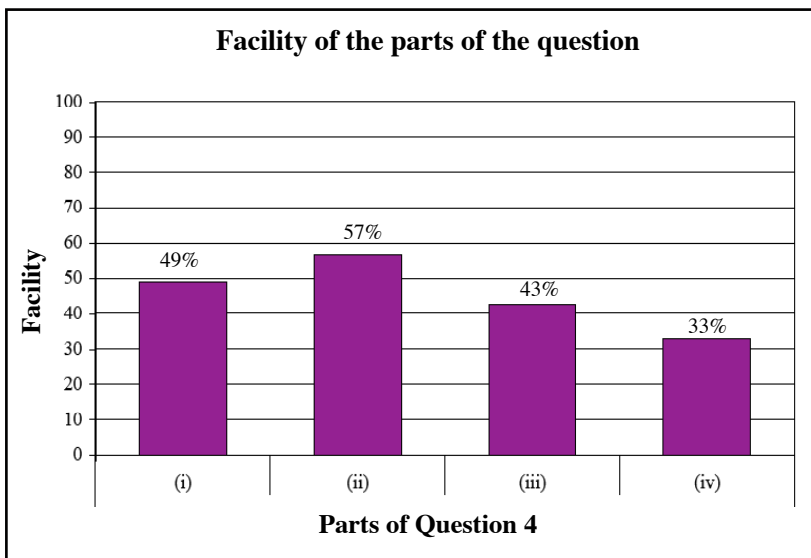
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Measurements' carries 10 marks. 62% of the candidates have selected it. Of these candidates,

about 57% have obtained marks in the interval 0 - 2, about 14% have obtained marks in the interval 3 - 5, about 8% have obtained marks in the interval 6 - 7, and about 21% have obtained marks in the interval 8 - 10.

71% of the candidates have obtained 5 marks or less for this question. Only 21% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (ii) with a facility of 57%. The most difficult part has been part (iv) with a facility of 33%. Overall facility of the question is 43%.

The percentage of candidates who have selected this question related to Trigonometry and bearings under the theme 'Measurements' is 62%. Part (i) of this question with four parts has a facility of 49%. It is found that candidates have failed to mark the bearings correctly which caused an error in calculating the value of the angle. It will be effective to train the students to pay more attention to the subject matter with better understanding.

Part (ii) is based on the simple geometrical theorem of the sum of the three interior angles of a triangle and its facility is 57%. Part (iii) given to test the ability in finding a length using trigonometric ratios has a facility of 43%.

The lowest facility is for part (iv) which is to calculate an angle using the trigonometric tables and it is 33%. Candidates need to practice writing the trigonometric ratios correctly and finding the values using the trigonometric tables. Candidates should gain knowledge by engaging in questions with alternative calculations and questions related to drawing simple figures and marking the given data.

Objectives of Question 5

Competency 17: Manipulates the methods of solving equations to fulfill the needs of day to day life.

Expected Learning Outcomes:

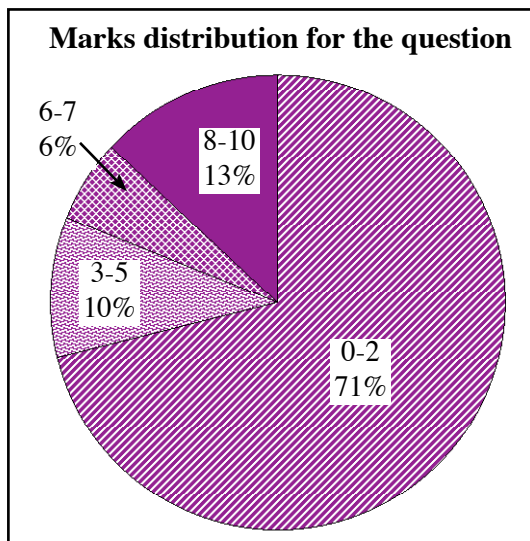
When the number of meters of cloth in two colours needed to sew uniforms for a group of boys and girls is given,

- (i) constructs a pair of simultaneous equations in two unknown terms using the information provided.
- (ii) finds the value of the two unknown terms by solving the two equations.
- (iii) when the sewing cost for a certain number of blouses and a certain number of skirts is given, where these are expressed in terms of an unknown, writes an expression for the sewing cost of a girl's uniform in terms of the unknown term and simplifies it.

5. The students in a hostel are to get new uniforms. Each girl is to receive a blouse and a skirt, and each boy is to receive a shirt and a pair of trousers. 1 metre of white material is required to sew a blouse and $1\frac{1}{2}$ metres of white material is required to sew a shirt. Moreover, $1\frac{1}{2}$ metres of blue material is required to sew a skirt and 2 metres of blue material is required to sew a pair of trousers. The total amount of white material required is 72 metres and the total amount of blue material required is 100 metres.
- (i) Taking the number of girls as x and the number of boys as y , construct a pair of simultaneous equations in x and y .
 - (ii) Solve the pair of simultaneous equations and find the number of girls and the number of boys in the hostel.
 - (iii) The sewing cost for m number of blouses is Rs 750 and the sewing cost for $2m$ number of skirts is Rs 1125. Write down an expression for the sewing cost of a girl's uniform in terms of m and simplify it.

Question Number		Answer	Marks		Other
5.	(i)	$x + 1\frac{1}{2}y = 72$ $1\frac{1}{2}x + 2y = 100$	1		
			1	②	
	(ii)	$2x + 3y = 144 \quad \text{-----} \quad \textcircled{1}$ $3x + 4y = 200 \quad \text{-----} \quad \textcircled{2}$ $\textcircled{1} \times 3 - \textcircled{2} \times 3$ $6x + 9y - (6x + 8y) = 144 \times 3 - 200 \times 2$ $y = 32$ <p>Substituting $y = 32$ into $\textcircled{1}$</p> $2x + 3(32) = 144$ $2x + 96 = 144$ $x = 24$ <p>No. of girls = 24</p> <p>No. of boys = 32</p>	2		Equating coefficients - 1 mark Eliminating one unknown - 1 mark Finding the value of an unknown - 1 mark
		1			
			1		
			1	⑥	
	(iii)	$\frac{750}{m} + \frac{1125}{2m}$ $= \frac{1500 + 1125}{2m}$ $= \frac{2625}{2m}$	1		
			1	②	10

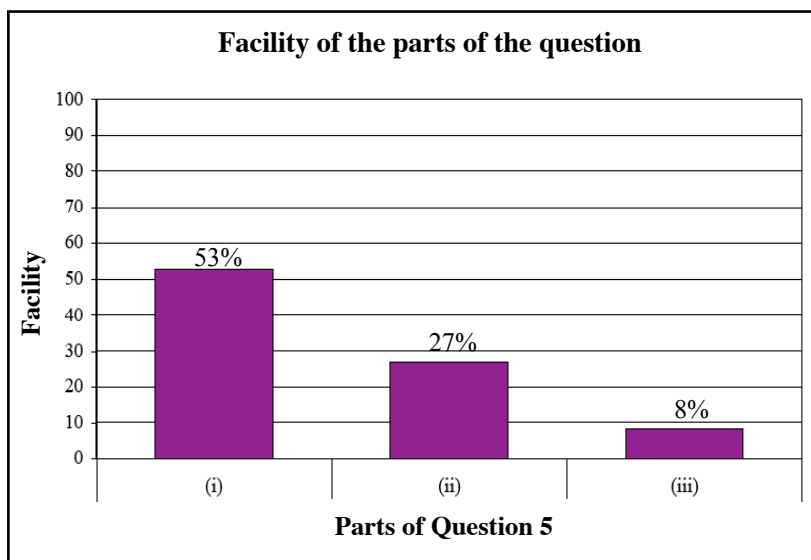
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Algebra' carries 10 marks. 57% of the candidates have selected it. Of these candidates,

about 71% have obtained marks in the interval 0 - 2, about 10% have obtained marks in the interval 3 - 5, about 6% have obtained marks in the interval 6 - 7, and about 13% have obtained marks in the interval 8 - 10.

81% of the candidates have obtained 5 marks or less for this question. Only 13% have obtained 8 marks or more.



This question consists of 3 parts. The easiest part has been part (i) with a facility of 53%. The most difficult part has been part (iii) with a facility of 8%. Overall facility of the question is 29%.

The percentage of candidates who selected and answered this question under the theme 'Algebra' is 57%. Through this question it is expected to measure the ability of the candidate to construct and solve simultaneous equations in two unknown terms with fractional coefficient and the ability to construct an algebraic equation using the given data and simplify it.

Part (i) which measures the ability to construct simultaneous equations in two unknown terms with fractional coefficients has a facility of 53%.

Only 27% of the candidates have correctly answered part (ii) which tests the ability in solving the pair of equations obtained in part (i). It is necessary to provide more practice in constructing equations from questions with complex statements and solving them. The accuracy of the solutions can be checked by substituting them in the equations constructed earlier.

Part (iii) which measures the ability in constructing an expression with algebraic fractions and simplifying it has a very low facility of 8%.

Objectives of Question 6

Competency 10: Gets the maximum out of space by working critically with respect to volume.

Expected Learning Outcomes:

- (a) When the radius and the height of a right circular cylindrical container and the height of the liquid in it is given,
- (i) finds the volume of the empty space in the container.
 - (ii) when the volume of water that spills out when a spherical object is completely immersed in the water in the above mentioned container is given, shows that the radius of the spherical object is the given surd.
- (b) Finds the value of an expression of the form $\frac{a}{b}$; $a, b \in \mathbb{R}$ and $0 < b < 1$ using the logarithms table.

6. (a) A right circular cylindrical container made from a thin material, of height 21 cm and radius 6 cm, is filled with water up to a height of 14 cm.

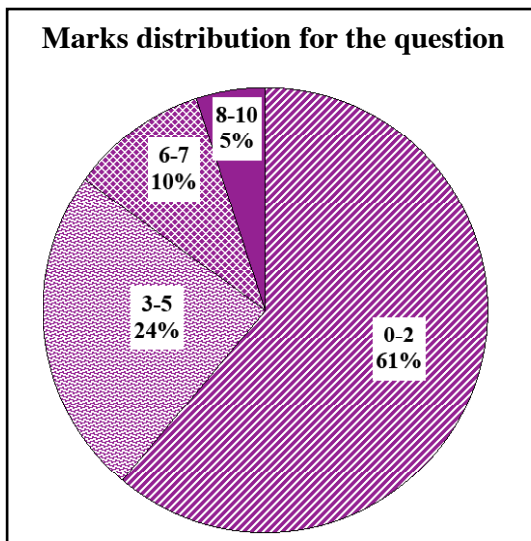
Take the value of π as $\frac{22}{7}$ in the following calculations.

- (i) Find the volume of the empty space in the container.
- (ii) If 44 cm^3 of water spills over when a solid spherical object is immersed completely in the water of the container, then show that the radius of the spherical object is $\sqrt[3]{199.5}$ centimetres.

- (b) Using the logarithms table, find the value of $\frac{\sqrt[3]{5}}{0.871}$.

Question Number			Answer	Marks		Other
6.	(a)	(i)	$\pi (6^2) \times 7$ $= \frac{22}{7} \times 36 \times 7$ $= 792 \text{ cm}^2$	1		
				1	(2)	
	(ii)	$\frac{4}{3} \pi r^3 = 44 + 792$ $\frac{4}{3} \times \frac{22}{7} \times r^3 = 836$ $r^3 = \frac{836 \times 21}{88}$ $r^3 = 199.5$ $r = \sqrt[3]{199.5}$	1			
			1	(3)		
(b)		$A = \frac{\sqrt[3]{5}}{0.871}$ $\lg A = \frac{1}{3} \lg 5 - \lg(0.871)$ $= \frac{1}{3} (0.6990 - (\bar{1}.9400))$ $= 0.2330 - (\bar{1}.9400)$ $= 0.2930$ $A = \text{antilog } (0.2930)$ $= 1.963$	1			
			1 + 1			
			1			
			1	(5)	10	

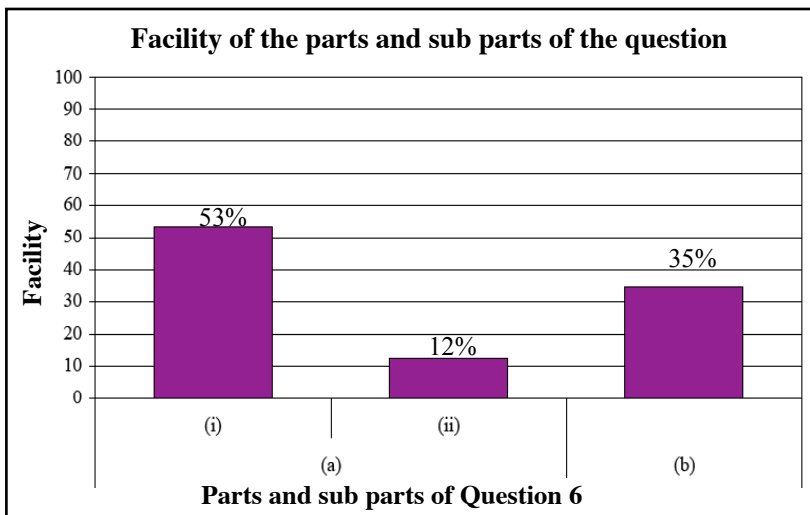
Observations, Conclusions and Suggestions regarding the answers :



This question based on the themes 'Numbers' and 'Measurements' carries 10 marks. 57% of the candidates have selected it. Of these candidates,

about 61% have obtained marks in the interval 0 - 2, about 24% have obtained marks in the interval 3 - 5, about 10% have obtained marks in the interval 6 - 7, and about 5% have obtained marks in the interval 8 - 10.

85% of the candidates have obtained 5 marks or less for this question. Only 5% have obtained 8 marks or more.



This question consists of 3 parts and sub parts. The easiest part has been sub part (a)(i) with a facility of 53%. The most difficult part has been sub part (a)(ii) with a facility of 12%. Overall facility of the question is 32%.

The percentage of candidates who have selected this problem on logarithms and volume under the themes 'Numbers' and 'Measurements' is 69%. The facility of the sub part (a) (i) is 53%. Its facility is low due to their use of data in calculations without understanding the problem. This weakness can be overcome largely by reading the question well and understanding it before answering.

Due to trying to answer without understanding the relationships, sub part (a) (ii), has a very low facility of 12%. Due to trying to obtain the answer by equalizing the spilt volume of water with the volume of the sphere, ignoring the empty space of the cylinder, the facility has dropped.

It is necessary to emphasize that candidates should have a better understanding of what is asked in the question in order to answer the question correctly.

For these questions based on the experience obtained in day to day life, models of the relevant solid objects can be used in practicing to improve effective answering. This may facilitate their ability of visualizing mental pictures related to the question.

Part (b) has a facility of 35% and it is related to logarithms. Candidates had difficulty in finding the cube root of a number using the logarithms table and in writing the characteristic of a number less than 1. Therefore candidates have to be trained to write the logarithms expression correctly and more exercises should be done for better performance and to gain experience in using the correct methods.

Part B

Objectives of Question 7

Competency 2: Makes decisions for future requirements by investigating the various relationships in number patterns.

Expected Learning Outcomes:

When the first term and the common difference are given in an instance where the consecutive terms are in an arithmetic progression,

- (i) writes an expression for the n th term and hence finds the value of the given term.
- (ii) writes an expression for the sum of ' n ' number of terms and simplifies and obtains the given expression.
- (iii) shows that the sum of a given number of terms is the given value.

When the condition for the sum of a certain number of terms to be a given value is expressed in terms of an unknown term,

- (iv) writes an equation in the unknown term and finds its value by solving the equation.

7. Isuri starts saving money by depositing Rs 5 in her till on the first day. After that, every day, she deposits Rs 2 more than the amount she deposited in the till on the previous day.

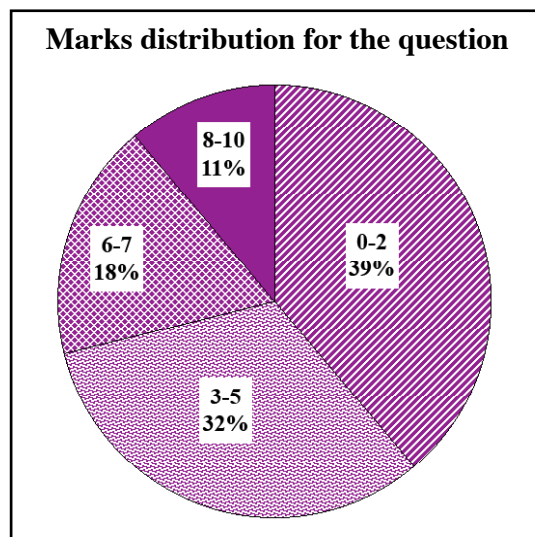
- (i) Write, in terms of n , an expression for T_n , the amount of money Isuri deposits in the till on the n^{th} day, and thereby find the amount of money she deposits in the till on the 26th day.
- (ii) Write, in terms of n , an expression for S_n , the total amount of money in the till at the end of the n^{th} day and by simplifying it, show that $S_n = n(n + 4)$.
- (iii) Show that the amount of money in the till at the end of the 26th day is Rs 780.

In order that the amount of money in the till at the end of the 30th day is Rs 1100, Isuri deposits, from the 27th day, x rupees more than the amount deposited on the previous day.

- (iv) Write down an equation in x and find the value of x by solving it.

Question Number		Answer	Marks		Other
7.	(i)	$T_n = 5 + (n - 1) 2$ or $3 + 2n$ $T_{26} = 5 + (26 - 1) 2$ $= 55$	1 1 1	(3)	
	(ii)	$S_n = \frac{n}{2} \{2 \times 5 + (n - 1) 2\}$ $= \frac{n}{2} \{10 + 2n - 2\}$ $= \frac{n}{2} \{8 + 2n\}$ $= n(4 + 1)$	1 1 1	(3)	
	(iii)	$S_{26} = 26(26 + 4)$ $= 26 \times 30$ $= 780$ \therefore Amount in the till is Rs. 780	1 1	(2)	
	(iv)	$S_n = \frac{n}{2} \{2a + (n - 1) d\}$ $1100 - 780 = \frac{4}{2} \{2 \times (55 + x) + (4 - 1)x\}$ $320 = 2 \{110 + 5x\}$ $160 - 110 = 5x$ $50 = 5x$ $x = 10$	1 1	(2)	$(55 + x) + (55 - 2x) +$ $(55 + 3x) + (55 + 4x)$ $= 1100 - 780$

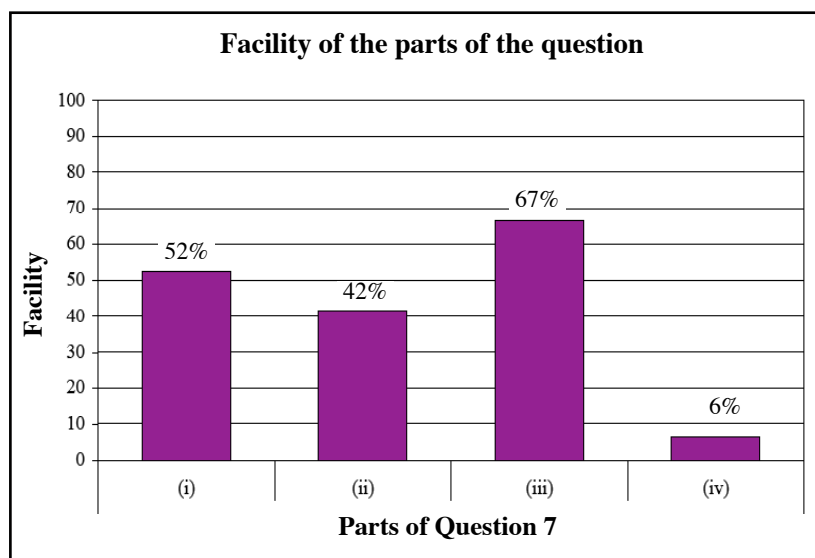
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Numbers' carries 10 marks. 78% of the candidates have selected it. Of these candidates,

about 39% have obtained marks in the interval 0 - 2,
 about 32% have obtained marks in the interval 3 - 5,
 about 18% have obtained marks in the interval 6 - 7,
 and about 11% have obtained marks in the interval 8 - 10.

71% of the candidates have obtained 5 marks or less for this question. Only 11% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (iii) with a facility of 67%. The most difficult part has been part (iv) with a facility of 6%. Overall facility of the question is 43%.

78% of the candidates have selected this question which tests the knowledge on arithmetic progressions under the theme 'Numbers'.

The facility of part (i) is 52%. It tests the ability in obtaining an expression for the n th term of an arithmetic progression and the ability in finding the value of a term using that expression. It is evident that the candidates have tried to find the relevant term by writing the n th term mechanically.

In part (ii) the data has been substituted correctly into the formula for the sum. But they have failed in obtaining the answer due to incorrect simplification. This has caused the drop in the facility to 42%.

Although the candidates could have obtained the answer for part (iii) easily by using the formula for S_n obtained in part (ii), candidates have attempted to get the solution by using the original formula for the sum. Due to not using this formula correctly and due to simplification errors, the facility of this part is 67%.

It is necessary to practice answering questions related to progression after having understood the question properly. Candidates need to improve their skills in constructing formulae with unknown terms and finding the value of an unknown term using a formula.

Objectives of Question 8

Competency 27 : Analyses according to geometric laws, the nature of the locations in the surroundings.

Expected Learning Outcomes:

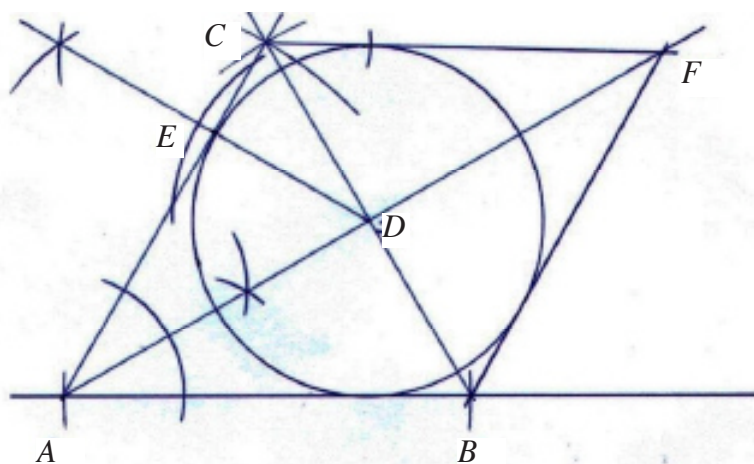
Using only a pair of compasses and a straight edge with a cm/ mm scale,

- (i) constructs an equilateral triangle when the length of a side is given.
- (ii) constructs the bisector of an angle of the triangle that is given, and names the point at which it meets a given side of the triangle.
- (iii) constructs a perpendicular from a given point to a given side and marks the foot of the constructed perpendicular.
- (iv) constructs a circle which touches a given straight line, by taking a given point as the centre.
- (v) constructs a tangent to the circle from a given point and marks the point where the produced tangent intersects a given straight line.
- (vi) writes the conditions for the given quadrilateral to be a rhombus.

8. ABC is an equilateral triangle with the length of each side 6 cm.

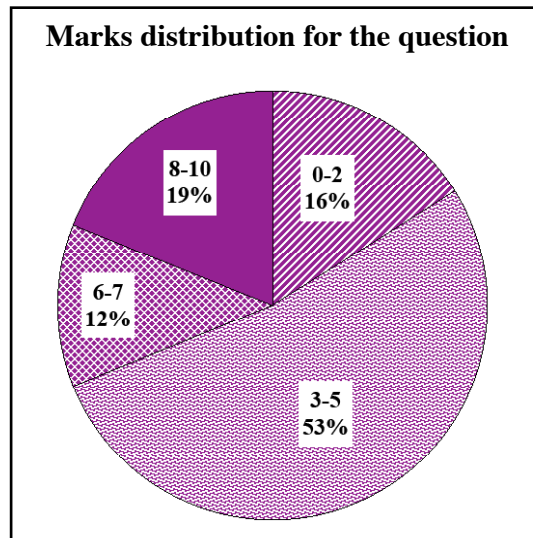
Use only a straight edge with a cm/mm scale and a pair of compasses for the following constructions. Show your construction lines clearly.

- (i) Construct the triangle ABC .
- (ii) Construct the angle bisector of \hat{BAC} and mark the point it meets BC as D .
- (iii) Construct the perpendicular from D to AC and mark its foot as E .
- (iv) Construct the circle with centre D , which touches the line AC .
- (v) Construct a tangent to this circle from C (other than AC), and mark the point it meets AD produced as F .
- (vi) Join B and F , and give reasons why $ABFC$ is a rhombus.



Question Number		Answer	Marks			Other
8.	(i)	Completing the triangle Drawing 6 cm line segment correctly - 1 Constructing 60° or 6 cm arcs - 1	3	③		
	(ii)	Constructing the angle bisector of \hat{BAC} and marking D	1	①		
	(iii)	Constructing the perpendicular from D and marking E	2	②		
	(iv)	Constructing the circle	1	①		
	(v)	Constructing the tangent CF	1	①		
	(vi)	Showing $ABFC$ is a parallelogram Showing one pair of adjacent sides are equal	1 1	②	10	

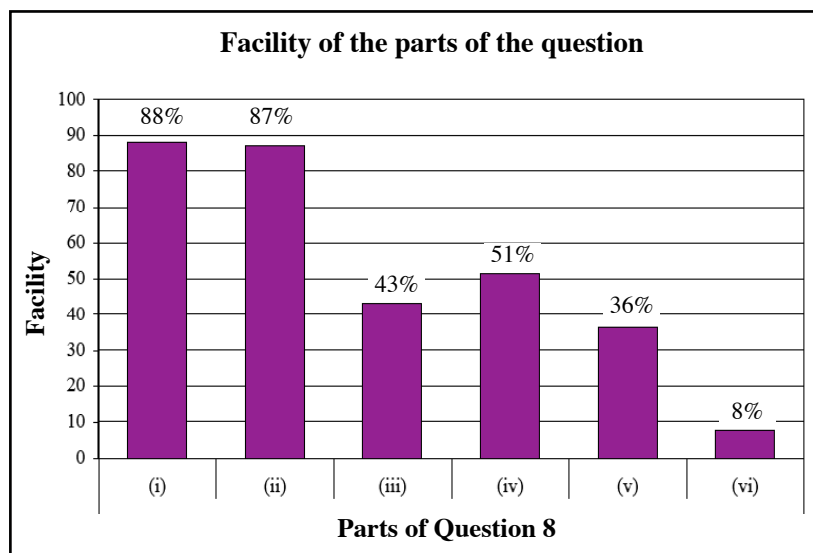
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Geometry' carries 10 marks. 89% of the candidates have selected it. Of these candidates,

about 16% have obtained marks in the interval 0 - 2,
about 53% have obtained marks in the interval 3 - 5,
about 12% have obtained marks in the interval 6 - 7,
and about 19% have obtained marks in the interval 8 - 10.

69% of the candidates have obtained 5 marks or less for this question. Only 19% have obtained 8 marks or more.



This question consists of 6 parts. The easiest part has been part (i) with a facility of 88%. The most difficult part has been part (vi) with a facility of 8%. Overall facility of the question is 58%.

The percentage that has selected this question on construction under the theme 'Geometry' is 89%. To construct accurately one should possess a proper understanding of the basic Loci and Geometry theorems.

The facility of part (i) is 88%. This shows that a majority of the candidates have the ability of constructing a triangle accurately. Part (ii) which tests the ability of naming a diagram accurately and constructing the bisector of an angle has a facility of 87%. Part (iii) which tests the ability of constructing a perpendicular to a straight line from a given exterior point has a lower facility. Candidates should know how to do such constructions using the given data accurately.

The constructions in parts (iv) and (v) test the knowledge on theorems related to tangents, One has to be familiar with the applications of these theorem to do these constructions. Part (vi) which is based on identifying the features of a rhombus has recorded a low facility of 8%. Candidates should be thorough with the specific features of a rhombus which is a significant type of parallelogram, in order to answer correctly.

Objectives of Question 9

Competency 29 : Analyses data by various methods and makes predictions to facilitate daily work.

Expected Learning Outcomes:

When data related to a situation is provided in a frequency distribution,

- (i) writes the modal class of the frequency distribution.
- (ii) finds the mean of the given data.
- (iii) using the mean, finds the expected income for a given situation.
- (iv) using the information given, estimates the value related to a described situation.

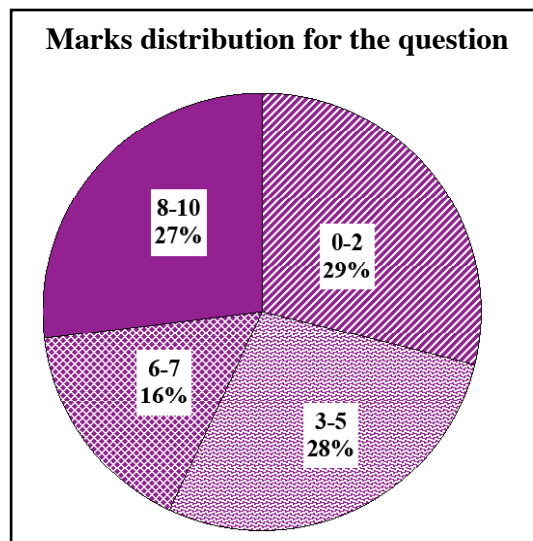
9. A frequency distribution containing information on the tickets issued to passengers during a morning trip of a bus is shown in the table below.

Price of a ticket (Rs)	8 - 12	12 - 16	16 - 20	20 - 24	24 - 28	28 - 32
Number of tickets	6	7	13	17	13	8

- (i) Write down the modal class of the distribution.
- (ii) Find the mean price of the tickets issued.
- (iii) Find the expected income from a morning trip in which tickets are issued to 180 passengers.
- (iv) Assuming that the total expenditure including fuel is Rs 700 for a morning trip, estimate the minimum number of tickets that should be issued to make a profit from such a trip.

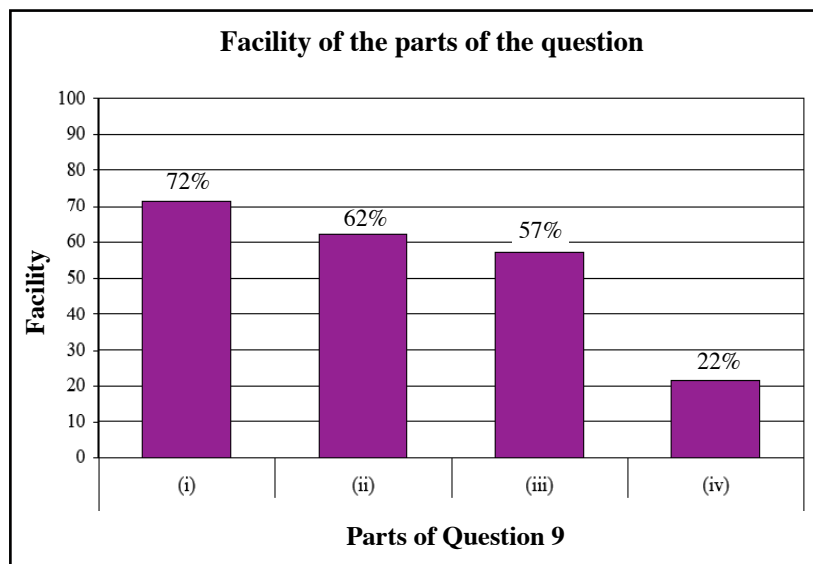
Question Number		Answer				Marks			Other																																
9.	(i)	20 - 24				1	(1)																																		
	(ii)	<table border="1"> <thead> <tr> <th>Class interval</th> <th>Number of tickets</th> <th>x</th> <th>fx</th> </tr> </thead> <tbody> <tr> <td>8 - 12</td> <td>6</td> <td>10</td> <td>60</td> </tr> <tr> <td>12 - 16</td> <td>7</td> <td>14</td> <td>98</td> </tr> <tr> <td>16 - 20</td> <td>13</td> <td>18</td> <td>234</td> </tr> <tr> <td>20 - 24</td> <td>17</td> <td>22</td> <td>374</td> </tr> <tr> <td>24 - 28</td> <td>13</td> <td>26</td> <td>338</td> </tr> <tr> <td>28 - 32</td> <td>8</td> <td>30</td> <td>240</td> </tr> <tr> <td></td> <td>64</td> <td></td> <td>$\sum fx = 1344$</td> </tr> </tbody> </table> x column ----- 1 fx column ----- 1 $\sum fx$ ----- 1 Mean price = $\frac{1344}{40}$ = Rs. 21				Class interval	Number of tickets	x	fx	8 - 12	6	10	60	12 - 16	7	14	98	16 - 20	13	18	234	20 - 24	17	22	374	24 - 28	13	26	338	28 - 32	8	30	240		64		$\sum fx = 1344$	1 1 1 1 1	(5)		Ignore one mistake. If assumed mean is used, give the mark for the fx column for the fd column. Give the mark for $\sum fx$ to $\sum fd$ This mark is given for correctly substituting the obtained values to the formula, when computing the mean price
Class interval	Number of tickets	x	fx																																						
8 - 12	6	10	60																																						
12 - 16	7	14	98																																						
16 - 20	13	18	234																																						
20 - 24	17	22	374																																						
24 - 28	13	26	338																																						
28 - 32	8	30	240																																						
	64		$\sum fx = 1344$																																						
	(iii)	Income = Rs. 180×2 = Rs. 3780				1 1	(2)		For multiplying by 180																																
	(iv)	$\frac{700}{21}$ = $33 \frac{1}{3}$ \therefore Minimum number of tickets is 34				1 1	(2)	10	For dividing by the obtained mean																																

Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Statistics' carries 10 marks. 91% of the candidates have selected it. Of these candidates, about 29% have obtained marks in the interval 0 - 2, about 28% have obtained marks in the interval 3 - 5, about 16% have obtained marks in the interval 6 - 7, and about 27% have obtained marks in the interval 8 - 10.

57% of the candidates have obtained 5 marks or less for this question. Only 27% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (i) with a facility of 72%. The most difficult part has been part (iv) with a facility of 22%. Overall facility of the question is 54%.

This question on the theme 'Statistics' given to find representative values using a frequency distribution, has a selection of 91%.

Part (i) which asks for the modal class has a facility of 72%. Candidates who studied the data well had found it easy.

Part (ii) which expects the mean to be found using class intervals has a facility of 62%. Here, it is not necessary to use an assumed mean to find the mean. On occasions when it is easy to find the mean directly by multiplying the mid values by the frequencies, it is not necessary to use an assumed mean.

Candidates need to calculate the mean by substituting the sum of the products of the mid values and frequencies in the relevant formula. They should know that an assumed mean should be used only when it is easier to calculate the mean by using it.

Part (iii) expects the income from the passengers to be found using the mean price of a ticket found in part (ii). It has a facility of 57%. Even though the answer can easily be obtained by multiplying the mean by the number of passengers, due to failure in calculating the correct mean and weaknesses in multiplication, it has a low facility.

The facility of part (iv) from which a candidate is expected to estimate the minimum number of tickets that need to be issued to obtain a profit from one bus trip, given the expenditure of the trip, is 22%. The candidates should understand that they need to round off the obtained answer to the higher whole number to find the minimum number of tickets that need to be issued to make a profit.

The inability to understand the meaning of the mean value and the relationship between the question in part (iv) and the mean value has caused the low facility. Candidates should improve the ability to use data to find the appropriate answer rather than to write the answer mechanically.

Objectives of Question 10

Competency 30 : Manipulates the principles related to sets to facilitate day to day activities.

Expected Learning Outcomes:

When the information regarding the universal set, a subset of the universal set and subsets of that subset, which intersect each other are provided,

- (i) draws the Venn diagram and marks the given data in it.
- (ii) finds the number of elements in a given set.

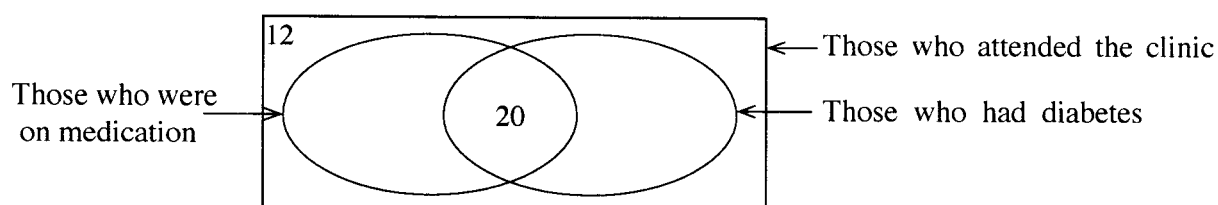
When an incomplete Venn diagram is given,

- (iii) fills the empty regions of the Venn diagram.
- (iv) finds the number of elements in a given set.

10. It was revealed that out of 40 persons who visited a medical clinic, 20 had heart diseases and 25 had diabetes. All those who had heart diseases and all those who had diabetes suffered from stress too. 3 persons suffered from stress only and 4 persons did not suffer from stress.

- (i) Draw a Venn diagram to depict this information and write down in it, the number of elements belonging to each region.
- (ii) How many persons had diabetes but did not have heart diseases?

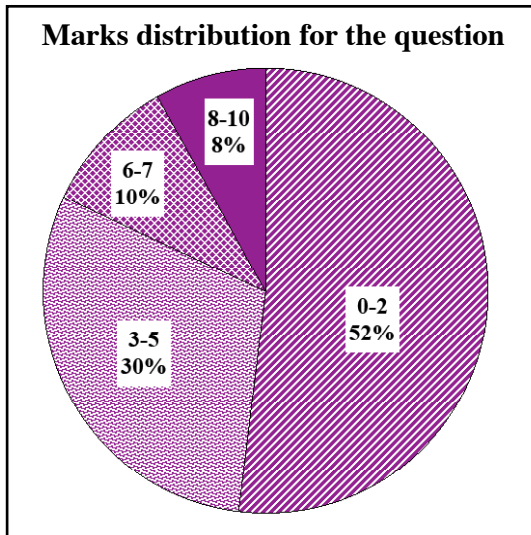
Among the 40 persons who visited the clinic, there were persons who were on medication and those who were not on medication as well. An incomplete Venn diagram drawn using this information too is shown below.



- (iii) Copy the Venn diagram given above and write down the values relevant to the two empty regions in it.
- (iv) How many persons had diabetes but were not on medication?

Question Number		Answer	Marks		Other
10.	(i)	<p>Heart diseases Diabetes Stress</p> <p>Indicating the heart diseases and diabetes sets correctly within the universal set</p> <p>Indicating the stress set such that the heart diseases and diabetes sets are subsets of it.</p> <p>Marking 3 and 4 in correct regions.</p> <p>Marking 8, 12 and 13 in correct regions.</p>	1		1 Mark for any correct answer
	(ii)	13	1	①	
	(iii)	<p>On medication Diabetes</p> <p>1+1 ②</p>	1+1	②	
	(iv)	5	1	①	

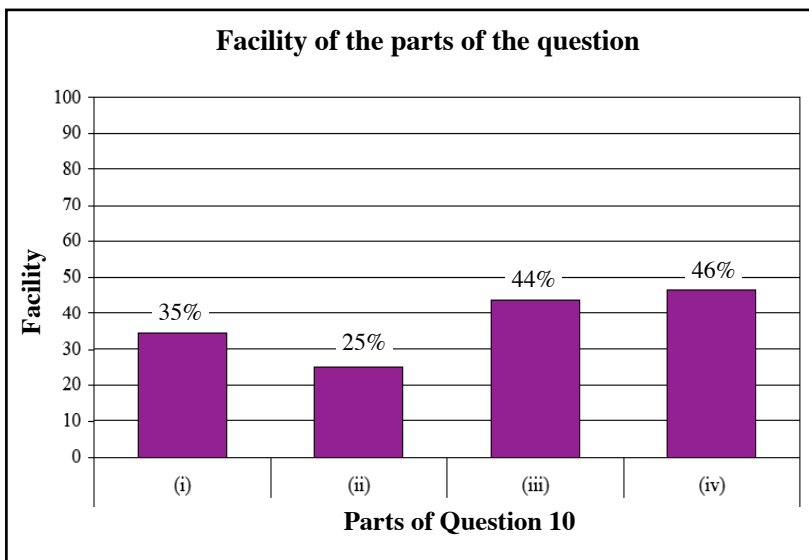
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Sets and Probability' carries 10 marks. 82% of the candidates have selected it. Of these candidates,

about 52% have obtained marks in the interval 0 - 2, about 30% have obtained marks in the interval 3 - 5, about 10% have obtained marks in the interval 6 - 7, and about 8% have obtained marks in the interval 8 - 10.

82% of the candidates have obtained 5 marks or less for this question. Only 8% have obtained 8 marks or more.



This question consists of 4 parts. The easiest part has been part (iv) with a facility of 46%. The most difficult part has been part (ii) with a facility of 25%. Overall facility of the question is 37%.

This question based on sets under the theme 'Sets and Probability' has a selection of 82%.

Part (i) that needed drawing a suitable Venn diagram and marking the data accurately has a facility of 35%. In representing the data in a Venn diagram, the relevant subsets should be identified correctly. Lack of this ability has resulted in this low facility. Language skills are essential in understanding how to draw the Venn diagram and to include the given data correctly.

Part (ii) which checks the ability in identifying the regions in a Venn diagram correctly has a facility of 25%. Unfamiliarity in drawing Venn diagrams specially with subsets and weakness in identifying the regions in a Venn diagram have resulted in this low facility level.

The above reasons have affected the answers in the remaining parts of the question too. These weaknesses can be avoided by engaging in exercises to improve communication skills through graphical representation and to improve the ability in identifying the regions in a Venn diagram correctly.

By engaging in different types of challenging questions in order to boost one's analytical thinking one can enhance the ability to answer such questions.

Objectives of Question 11

Competency 23 : Make decisions regarding day to day activities based on geometrical concepts related to rectilinear plane figures.

Expected Learning Outcomes:

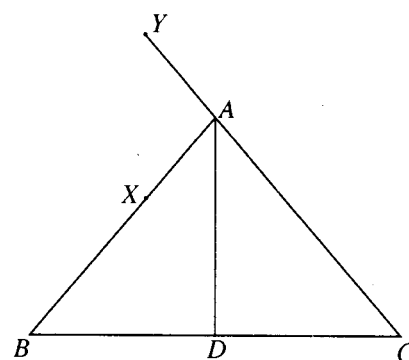
When an isosceles triangle with a produced side and an angle bisector are given,

- (i) copies the figure and marks the given information.
- (ii) shows that the two triangles named are congruent.

When the point where a line meets a side of the triangle is given,

- (iii) shows that the two angles named are equal.
- (iv) shows that the value of an angle named is equal to the sum of two other named angles.
- (v) shows that two lines are parallel.

11. In the given figure, $\hat{A}BC = \hat{A}CB$, X is a point on AB and Y is a point on CA produced such that $AY = AX$. The angle bisector of $\hat{B}AC$ meets BC at D .



- (i) Copy the figure and indicate the information given above in it.
- (ii) Show that $\triangle ABD \cong \triangle ADC$.

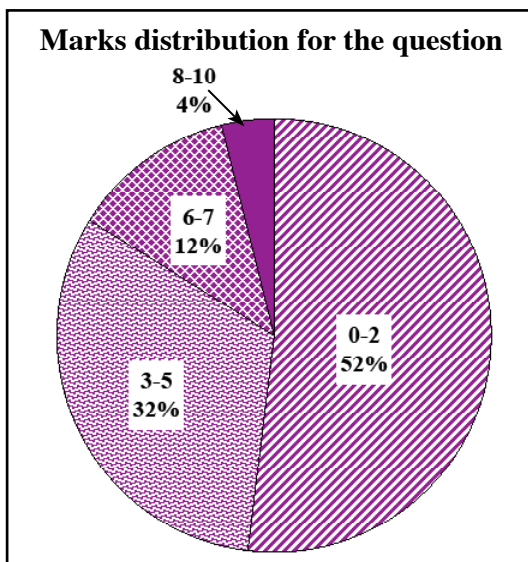
YX produced meets BD at E .

- (iii) Show that $\hat{X}YA = \hat{B}XE$.
- (iv) Show that $\hat{B}EX = \hat{B}XE + \hat{E}BX$.
- (v) Show that $XE \parallel AD$.

Question Number		Answer	Marks			Other
11.	(i)		1	(1)		
	(ii)	$ABD \Delta$ and $ADC \Delta$ $\hat{B}AD = \hat{C}AD$ (since AD is the bisector of $\hat{B}AC$) $\hat{A}BD = \hat{A}CD$ (given) AD is common $\therefore ABD \Delta \cong ADC \Delta$ (A.A.S.)	1 1 1			(3)

Question Number		Answer	Marks		Other
11.	(iii)	$\hat{A}YX = \hat{A}XY$ ($\because AY \parallel AX$) but $\hat{A}YX = \hat{B}XE$ (vertically opposite angles) $\therefore \hat{A}YX = \hat{B}XE$	1		
			1	(2)	
	(iv)	$\hat{B}EY = \hat{E}CY + \hat{C}YE$ (applying the exterior angle theorem to the triangle ECY) $\hat{B}CY = \hat{E}BX$ (given) $\hat{C}YE = \hat{E}XB$ (proved in iii) $\therefore \hat{B}EX = \hat{B}XE + \hat{E}BX$	1		
			1	(2)	
	(v)	$\hat{A}DB = \hat{A}DC$ (corresponding angles in congruent triangles) $\hat{A}DB + \hat{A}DC = 180^\circ$ (sum of adjacent angles on a straight line) $\therefore \hat{A}DB = 90^\circ$ $\hat{B}EX = \hat{C}EY$ (from (iv) and exterior angle theorem) \therefore as above $\hat{B}EX = 90^\circ$ Since corresponding angles are equal, $XE \parallel AD$	1		$\hat{X}AD = \frac{\hat{B}AC}{2}$ (AD is the angle bisector) (1) $\hat{X}AC = \hat{A}YX + \hat{Y}XA$ (applying exterior angle theorem to $AYX \Delta$) (1) $= 2 \hat{A}XY$ ($\hat{A}YX = \hat{Y}XA$) $\therefore \hat{X}AD = \frac{2 \hat{A}XY}{2} = \hat{A}XY$ (since alternate angles are equal $XE \parallel AD$)
			1	(2)	

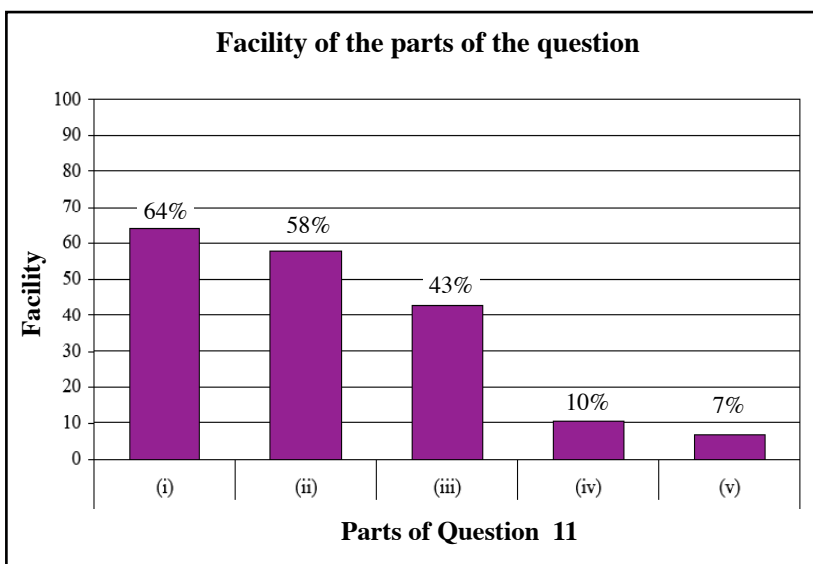
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Geometry' carries 10 marks. 51% of the candidates have selected it. Of these candidates,

about 52% have obtained marks in the interval 0 - 2, about 32% have obtained marks in the interval 3 - 5, about 12% have obtained marks in the interval 6 - 7, and about 4% have obtained marks in the interval 8 - 10.

84% of the candidates have obtained 5 marks or less for this question. Only 4% have obtained 8 marks or more.



This question consists of 5 parts. The easiest part has been part (i), with a facility of 64%. The most difficult part has been part (v), with a facility of 7%. Overall facility of the question is 40%.

This question related to the congruence of triangles and to theorems on triangles under the theme 'Geometry' has a selection of 51%.

Part (i), which is given to check the ability in marking data on a diagram has a facility of 64%. This value is low due to poor knowledge on geometrical facts.

Part (ii) which measures the knowledge on the congruence of triangles has a facility of 58%. To answer this question, students should possess knowledge on the different cases of the congruence of triangles while understanding the similarities and differences in the elements of the triangles. Part (iii) based on the features of isosceles triangles has a facility of 43%. Not having proper understanding of the theorems on triangles, poor application of the theorems and not identifying vertically opposite angles have resulted in a low facility. By enhancing the abilities related to the above, candidates can be guided to answer these questions well.

Parts (iv) and (v) on theorems related to exterior angles and adjacent angles on a straight line have recorded low facilities. Not seeing the connections to these theorems and poor skills in using axioms have greatly contributed to this low facility level.

Enhancing the ability to use axioms and encouraging a proper understanding of the theorems will help in answering these types of questions successfully.

Objectives of Question 12

Competency 24 : Thinks logically when making decisions based on geometrical concepts related to circles.

Expected Learning Outcomes:

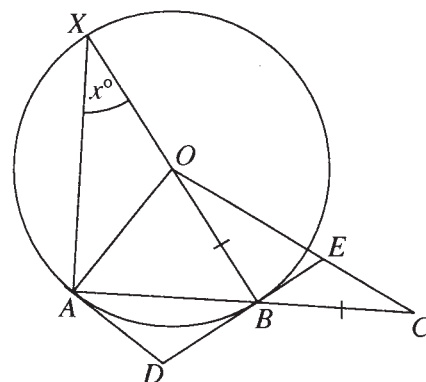
When a figure with data marked in it and one angle marked as x is given, finds with reasons, the angles named in (i), (ii), (iii), (iv), (v) in terms of x . By using the angles obtained in terms of x , shows that the triangle named in (vi) is an equilateral triangle.

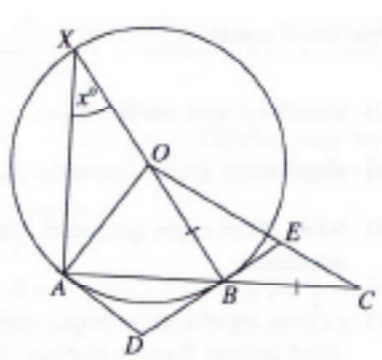
12. In the given figure, AB is a chord of the circle with centre O . The point C is on AB produced such that $OB = BC$. The line BO produced meets the circle again at X . The tangents drawn to the circle at A and B meet at D . DB produced meets OC at E .

If $\hat{A}XO = x^\circ$, giving reasons, find the following angles in terms of x .

- (i) $\hat{A}OB$
- (ii) $\hat{O}BA$
- (iii) $\hat{B}OD$
- (iv) $\hat{B}OE$
- (v) $\hat{B}EO$

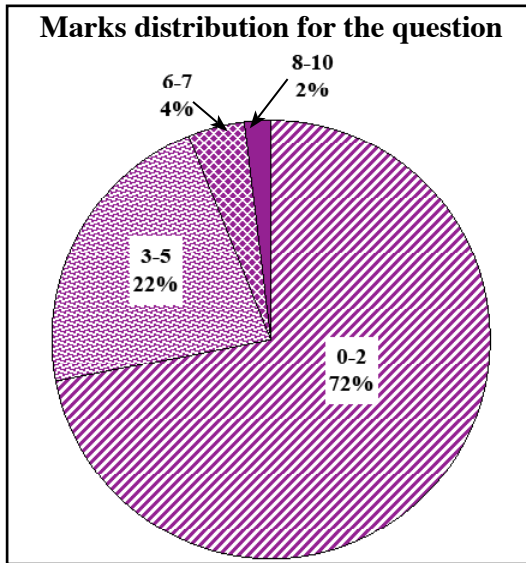
By using the angles obtained in the above parts, (vi) show that ODE is an isosceles triangle.



Question Number	Answer	Marks	Other
12. (i)	 <p>$\hat{A}OB = 2x^\circ$ (angle subtended by an arc of a circle at the centre is equal to twice the angle subtended on the circle)</p>	1 + 1 (2)	
(ii)	<p>$\hat{O}BA = 90^\circ - x^\circ$ (since XB is diameter $\hat{X}AB = 90^\circ$)</p>	1 + 1 (2)	$\hat{O}BA = \frac{180^\circ - 2x^\circ}{2} = 90^\circ - x^\circ$ <p>($\because OA = OB$) (1)</p>

Question Number		Answer	Marks		Other
12.	(iii)	$\therefore \hat{BOD} = \frac{1}{2} \hat{AOB} = x^\circ$ (tangents drawn from an exterior point to a circle subtend equal angles at the centre.)	1	(1)	
	(iv)	$\hat{BOE} = \frac{1}{2} \hat{OBA} = \frac{90^\circ - x^\circ}{2} \quad (BO = BC)$ or $= 45^\circ - \frac{x^\circ}{2}$	1 + 1	(2)	
	(v)	$\hat{BOE} = 90^\circ - (45^\circ + \frac{x^\circ}{2}) \quad (\because DB \perp OB)$ $= 45^\circ + \frac{x^\circ}{2}$	1	(1)	
	(vi)	$\hat{DOE} = 45^\circ + \frac{x^\circ}{2}$ $\therefore OD = DE \quad (\because \hat{DOE} = \hat{OED})$ $\therefore ODE \Delta \text{ is isosceles.}$	1 1	(2)	10

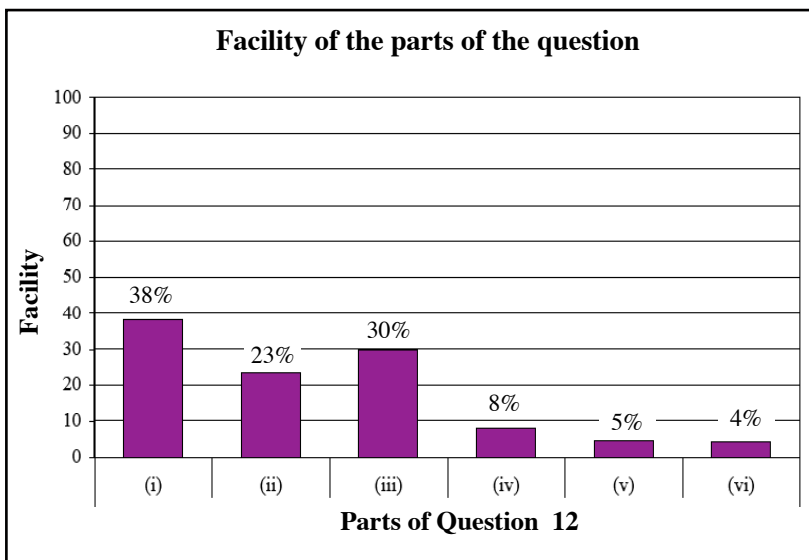
Observations, Conclusions and Suggestions regarding the answers :



This question based on the theme 'Geometry' carries 10 marks. 26% of the candidates have selected it. Of these candidates,

about 72% have obtained marks in the interval 0 - 2, about 22% have obtained marks in the interval 3 - 5, about 4% have obtained marks in the interval 6 - 7, and about 2% have obtained marks in the interval 8 - 10.

94% of the candidates have obtained 5 marks or less for this question. Only 2% have obtained 8 marks or more.



This question consists of 6 parts. The easiest part has been part (i) with a facility of 38%. The most difficult part has been part (vi) with a facility of 4%. Overall facility of the question is 20%.

This question has been given to test the knowledge on the theorems on angles related to circles, tangents and plane figures under the theme 'Geometry'. This is the question with the least selection by candidates, It is 26% as a percentage. The easiest part has been part (i) with a facility of 38% and the hardest part has been part (vi) with a facility of 4%.

None of the expected answers were numerical, and along with each answer, the correct reason had to be stated. For this, the candidates have to be familiar with the relevant theorems and in identifying their relationships. This was not evident and was the cause for the lack of success in providing answers.

This weakness can be minimized by enhancing students' knowledge on the geometrical features of plane figures, as well as their skills in applying the theorems related to circle in problems, starting from simple questions and proceeding to more complex ones.

Part III

3. Factors to be considered when answering questions and suggestions:

3.1 Factors to be considered when answering questions.

- * The general instructions in the question paper should be read carefully and understood well. That is, students should pay attention to the following: How many questions should be answered from each part? Which questions are compulsory? How much time is available? How many marks are allocated? Students should also read the questions carefully and clearly understand what is expected before selecting the questions.
- * The candidate's index number should be written on every page in the space provided for it.
- * The answers to the questions in Paper I should be written on the question paper itself.
- * When answering the questions in Paper II, each main question should be started on a new page.
- * Answers should be written clearly and legibly.
- * Numbers related to the question, its parts and sub-parts should be written accurately.
- * For problems which require sentences to be written, the relevant steps should be clearly stated.
- * In proofs of given results, logical reasons for each step must be indicated.
- * Depending on how the question is asked, facts should be presented in a logical and analytical way.
- * It is advisable to do the calculations for each and every question next to the solution itself.
- * The initial page of the answer script should be completed accurately.
- * Only blue or black pens should be used.

Special Instructions

- * When figures have to be drawn, they should be presented very clearly.
- * When performing calculations, each step should be written clearly.
- * The final answer should be written clearly and according to what has been asked.
- * Attention should be paid to write any final solution which is either a fraction or a ratio in its simplest form.
- * When required, the correct units should be used. The units relevant to the final answer should be in the standard form.
- * Candidates should pay attention to their handwriting and write all numbers and symbols clearly and accurately.
- * Candidates should note that, considering the simplification required for a mathematical problem as rough work and not presenting it in the solution, results in the candidate not receiving the marks assigned for the relevant step.
- * When answering the problems on geometry, the necessary steps should be written down logically with the appropriate reasons.
- * It should be mentioned that for problems on geometry, including the given data and also the derived data in the relevant figure will facilitate the discovery of the steps required to develop the correct answer.
- * On occasions when the complete answer cannot be provided for a question, at least the steps that can be presented accurately should be written.
- * Since some of the parts that come later in a question may be easier as well as independent of the earlier parts, it is important not to give up on a question if the initial parts are difficult, but to pay attention to all the parts.

3.2 Comments and suggestions regarding the teaching - learning process

- * It is important for teachers as well as students to be aware of the resources such as the Syllabus, Teachers' Instructional Manual, Textbooks and other external resources that are available to them and to make use of them.
- * Students should be informed of what they will be learning during a lesson.
- * More attention needs to be paid to the multiplication tables since students lose a lot of marks due to the mistakes they make in multiplications and divisions as a result of not knowing the multiplication tables.
- * Students need to also pay attention and correctly manipulate the mathematical operations with respect to fractions and decimals. It is productive to conduct a programme to develop their skills on manipulating the basic mathematical operations.
- * It is also productive to use learning aids and practical activities in the teaching learning process to inculcate the correct mathematical concepts in even the weaker students.
- * Subject content such as Geometry which is considered difficult should be first introduced using simple numerical exercises involving figures and gradually developed towards abstract concepts. The teacher should use different techniques and strategies in this effort.
- * To overcome the weaknesses with respect to basic algebraic concepts developed during the lower classes, the teacher should pay greater attention to establish these concepts.
- * To be successful in problem solving which is one of the special aims of learning mathematics, other skills too should be simultaneously developed and challenging problems which stimulate the mind be gradually introduced.
- * Students should be given the confidence that they can do mathematics. For this, the teacher should use various methods. Short methods, games, fun activities, memory games, quizzes are some examples.
- * It should be the responsibility of the teacher to inform students that mathematics which is an important and fundamental subject in the curriculum, is necessary for higher education as well as for future jobs and that it has a close relationship with normal day to day life.
- * Teachers who continuously work to advance and update their knowledge are skilled and creative people who are a great gift to students.
- * A programme should be initiated to minimize the effects of poor literacy skills which affect students' understanding of questions as well as their communication skills.
- * It is important in Grade 11 not be just limited to the textbook of that year, but to also revise the knowledge gained in lower grades.
- * Students need to be guided to pay more attention to perform reverse operations such as finding the cost price when the selling price is given. In other words, they need to develop not only skills in performing operations towards a solution but in the reverse order as well, when answering a mathematical problem.