Quantitative Analysis

- 69% of the students scored full marks.
- 26% of them gave incorrect answer while 5% did not attempt.

Common Errors Committed by students

- Most of students gave correct answer but a few gave answer as probability (black) = $\frac{6}{4}$ i.e. Probability of an event can not be more than 1 is not clear in the minds of students

Suggestive Remedial Measures

- Concept of Probability of an event = $\frac{\text{No. of favourable outcomes to the event}}{\text{Total number of possible outcomes.}}$ has to be taken with the students by giving different examples.

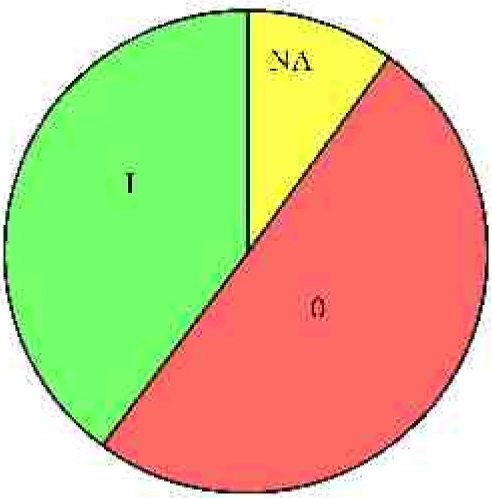
10. Find the median class of the following data:

Marks obtained	0-10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
Frequency	8	10	12	22	30	18

Ans. 30 – 40 1 m

Performance

Marks	N.A.	0	1	Mean Score
Percentage	10	50	40	0.4



Quantitative Analysis

- Only 40% of the students could score full-marks.
- A majority of the students (60%) either did not attempt or gave incorrect answer.

Common Errors Committed by students

- Some students have no knowledge of 'median class' although, some of them have calculated the median correctly.
- A few has given answer = 40 as they could not differentiate between class and the lower/higher limit.

Suggestive Remedial Measures

- The terms like class interval, class mark, frequency, median/modal class etc should be properly defined and questions should be asked inrolving these terms so that students become familiar.

SECTION B

Questions number 11 to 15 carry 2 marks each.

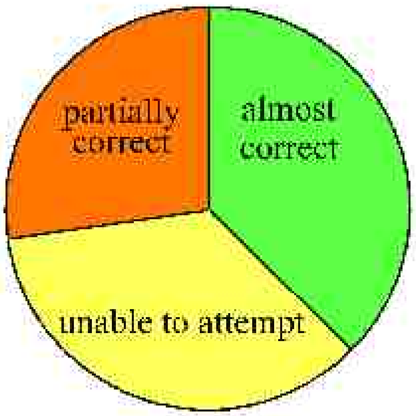
11. Find the quadratic polynomial sum of whose zeros is 8 and their product is 12.
Hence, find the zeros of the polynomial.

Ans. Getting $p(x) = x^2 - 8x + 12$ 1 m

Getting zeroes as 2, 6 1 m

Performance

Marks	N.A.	0	½	1	1½	2	Mean Score
Percentage	10	26	5	22	4	33	1.1



Quantitative Analysis

- 37% of the students either got full marks or 1½ marks.
- 27% of the students gave partially correct answer. while 36% of the students either did not attempt or gave a completely irrelevant answer and so got zero marks.

Common Errors Committed by students

- A good number of students gave the answer as an equation $x^2 - 8x + 12 = 0$ and not the polynomial.
- Many students took the sum of zeroes = 8 and product of zeroes = 12 as two zeroes of the polynomial & gave the answer as $x^2 - (8 + 12)x + (8)(12)$

$$= x^2 - 20x + 96$$

- A few of them gave the answer of the polymial correct as $x^2 - 8x + 12$, but left the question here, and did not find the zeroes.

Suggestive Remedial Measures

- concept of formation of polynomial as = x^2 – (sum of zeroes) x + product of zeroes, should be clearly under stood.

  Sufficient practice should be given by taking different examples where either zeroes are given or their sum and product are given.

- Habit of reading every part of the question has to be developed by pointing out such type of errors committed in terminal examinations held at school level.

12. In Figure 4, OP is equal to diameter of the circle. Prove that ABP is an equilateral triangle.

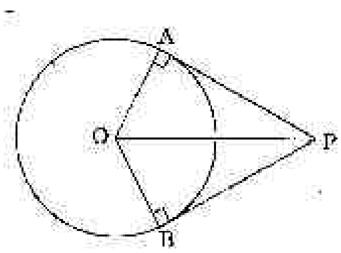
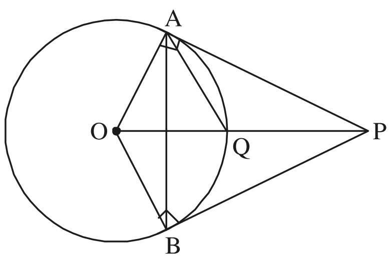


Figure 4

Ans.



Since OP = diameter $\therefore$ OQ = QP = radius ½ m

$\therefore$ OAP is right triangle and Q is mid point of OP

$\therefore$ OQ = QP = AQ [mid point of hypotenuse is equidistant from vertices] ½ m

$\therefore$ OA = OQ = AQ $\Rightarrow \angle$ AOP = 60° $\therefore \angle$ APO = 30° ½ m

Similarly $\angle$ BPO = 30° $\Rightarrow \angle$ APB = 60° ½ m

AP = BP $\Rightarrow \angle$ PAB = $\angle$PBA = 60°

$\therefore$ ΔPAB is equilateral.

Alternate method

In ΔOAP, $\frac{OA}{OP} = \frac{1}{2}$ or $\sin(\angle APO) = \frac{1}{2} \Rightarrow \angle APO = 30°$

$\therefore \angle BPO = 30°$ 1 m

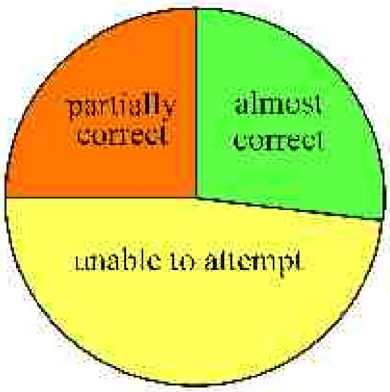
$\Rightarrow$ $\angle$ APB = 60° 1 m

AP = BP $\Rightarrow \angle$ PAB = $\angle$ PBA = 60°

$\therefore$ Δ PAB is an equilateral triangle.

Performance

Marks	N.A.	0	½	1	1½	2	Mean Score
Percentage	20	28	10	15	3	24	0.9



Quantitative Analysis

- Only 27% of the students could either got full marks or 1½ marks.
- 25% of the students gave partially correct answer white almost half of the students (48%) either did not attempt or gave irrelevent answer and so got zero marks.

Common Errors Committed by students

- Use of trigonometric ratios to prove geometrical results, is not very common with students while this method becomes very useful in some of the questions.
- Many students could not think that Q is the mid point of OP.
- Students could not recall the result that the mid point of the hypotenuse is equidistant from vertices of a right triangle, i.e. OQ = PQ = AQ.

Suggestive Remedial Measures

- Students should be encouraged to use trigonometric results in Geometry, especially where the ratio of sides is given or the angles are $30^\circ, 45^\circ, 60^\circ$.
- Application of the results of Geometry must be given sufficient practice.

13. Without using trigonometric tables, evaluate the following:

$$(\sin^2 25° + \sin^2 65°) + \sqrt{3}\ (\tan 5° \tan 15° \tan 30° \tan 75° \tan 85°)$$

Ans. For $\sin 65° = \sin (90 - 25)° = \cos 25°$

$\tan 85° = \cot 5°, \tan 75° = \cot 15°, \tan 30° = \dfrac{1}{\sqrt{3}}$ 1 m

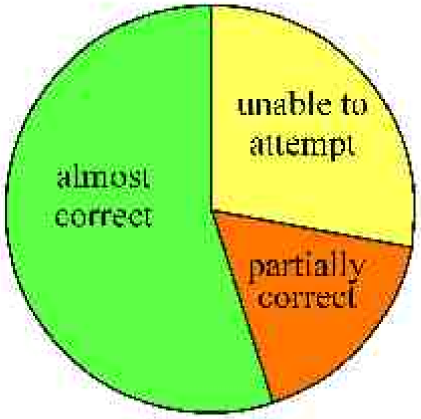
Given expression becomes

$$= (\sin^2 25° + \cos^2 25°) + \sqrt{3}\left[\tan 5° \tan 15° \frac{1}{\sqrt{3}} \cot 15° \cot 5°\right]$$ ½ m

$$= 1 + \sqrt{3}\left(\frac{1}{\sqrt{3}}\right) = 2$$ ½ m

Performance

Marks	N.A.	0	½	1	1½	2	Mean Score
Percentage	12	16	6	11	5	50	1.4



Quantitative Analysis

- 55% of the students scored almost full marks.
- Only 17% of the students gave partially correct answer white 28% of them either did not attempt or gave irrelevent answer.

Common Errors Committed by students

- The following careless mistakes were committed

(i) $1+\sqrt{3}\cdot\frac{1}{\sqrt{3}}=1$

(ii) $\sin^2 25^\circ + \sin^2 65^\circ = \sin^2(25^\circ + 65^\circ) = \sin^2 90^\circ$

(iii) $\tan 5^\circ = \tan(90^\circ - 5^\circ)$

(iv) $\sin^2 25^\circ = \cos^2(90^\circ - 65^\circ)$

Suggestive Remedial Measures

- Sufficient practice is to be given for questions like:

$56^\circ = (90^\circ - 34^\circ)$

$\therefore \quad \sin 56^\circ = \sin(90^\circ - 34^\circ)$

$= \cos 34^\circ \; [\because \sin(90-\theta) = \cos\theta]$

OR $\sin 56^\circ = \cos(90^\circ - 56) \; [\because \sin\theta = \cos(90-\theta)]$

$= \cos 34^\circ$

Students should follow one of the above two approaches.

- Computational errors can be minimised by giving more and more problems involving the use of basic operations.

14. For what value of k are the points (1, 1), (3, k) and (–1, 4) collinear?

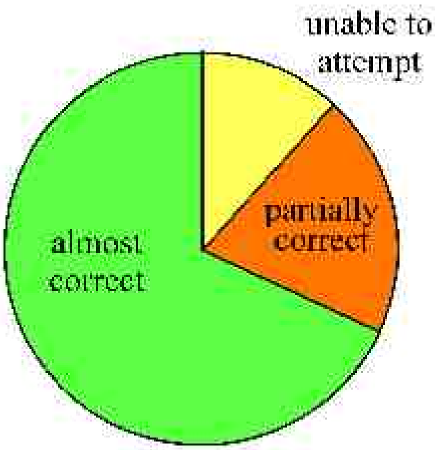
Ans. If A, B, C are collinear, then ar Δ ABC = 0 ½ m

$\therefore\ 1\ (k-4) + 3\ (4-1) - 1\ (1-k) = 0$ 1 m

$k - 4 + 9 - 1 + k = 0,\ 2k = -4\ \therefore\ k = -2$ ½ m

Performance

Marks	N.A.	0	½	1	1½	2	Mean Score
Percentage	6	6	–	20	6	62	1.6



Quantitative Analysis

- Majority of students (68%) secured almost full marks in this question.
- 20% of the students could get 1 mark as they made some errors.
- 12% of the students either could not attempt or gave irrelevent answer and so scored zero.

OR

Find the area of the Δ ABC with vertices A(–5, 7), B(–4, –5) and C(4, 5).

For area of $\Delta = \frac{1}{2}\ [x_1\ (y_2 - y_3) + x_2\ (y_3 - y_1) + x_3\ (y_1 - y_2)]$ ½ m

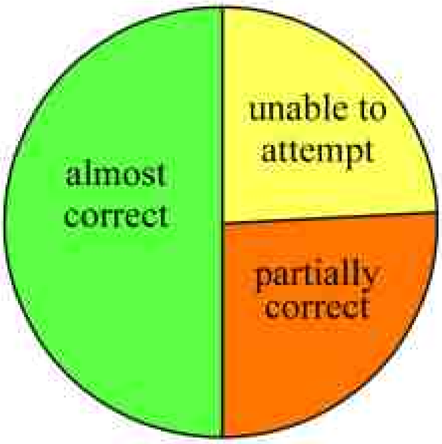
$= [-5\ (-5-5) + (-4)\ (5-7) + 4\ (7+5)]$ ½ m

$= [50 + 8 + 48] = \frac{1}{2}\ (106)$ ½ m

= 53 sq. units ½ m

Performance

Marks	N.A.	O	½	1	1½	2	Mean Score
Percentage	6	18	6	20	2	48	1.4



Quantitative Analysis

- 50% of the students could score almost full marks.
- 26% of the students committed errors & so could score up to 1 mark.
- 24% of the students either did not attempt or gave irrelevant answer and so got no mark.

Common Errors Committed by students

- A large number of students had written the formula for area of triangle correctly, but made errors in:

  (i) substituting the values or

  (ii) in computations like

  $y_1 = 7,\ y_2 = -5,\ y_3 = 5$

  $y_1 - y_2 = 7 - 5 = 2,\ \ y_2 - y_3 = -5 - 5 = 0$

- A few students committed errors while writing the formula for area of triangle like

$$\Delta = \frac{1}{2}\,[x_1 + (y_2 - y_3) + x_2 + (y_3 - y_1) + x_3 + (y_1 - y_2)]$$

or $$\Delta = \frac{1}{2}\,[x_1\,(y_2 - y_3)\,x_2\,(y_3 - y_1)\,x_3\,(y_1 - y_2)]$$

Suggestive Remedial Measures

- Operations of addition and multiplication with +ve and-ve numbers, needs a lot of care and practice. So sufficient practice must be given.
- While substituling values, sufficient practice of identifying x_1, y_1 etc will only minimise errors.

15. Cards, marked with numbers 5 to 50, are placed in a box and mixed thoroughly. A card is drawn from the box at random. Find the probability that the number on the taken out card is

(i) a prime number less than 10.

(ii) a number which is a perfect square.

Ans. Total number of cards = 46 ½ m

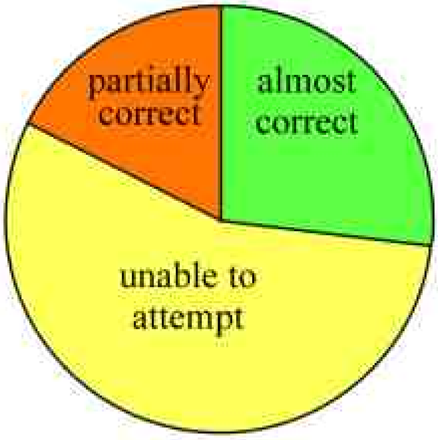
(*i*) P (a prime number < 10) = $\frac{2}{46} = \frac{1}{23}$ ½ m

(*ii*) P (a number which in a perfect square) = $\frac{5}{46}$ 1 m

i.e. (9, 16, 25, 36, 49)

Performance

Marks	N.A.	0	½	1	1½	2	Mean Score
Percentage	8	48	9	8	2	25	0.7



Quantitative Analysis

- Only 27% of the students could score almost full marks.
- Only 17% of the students gave partially correct answer.

- Almost half of the students either could not attempt or gave incorrect answer and so got zero marks.

Common Errors Committed by students

- A majority of students either could not attempt or gave irrelevent answers as the concept of prime numbers, perfect squares and counting the numbers between two natural numbers, is not clear to most of the students. The following errors were committed.
  (i) Number of cards marked 5 to 50 = 50 – 5 = 45
  (ii) Prime numbers less than 10 are 2, 3, 5, 7, but cards were from 5 to 50, so 2, 3 were to be ignored.
  (iii) Some of the students made mistakes in finding the perfect squares between 5 and 50.

Suggestive Remedial Measures

- (i) The concept of numbers (i) From n_1 to n_2

  (ii) Between n_1 and n_2

  should be clarified by taking different examples to get the concept as

  Numbers from n_1 to n_2 = $(n_2 - n_1 + 1)$

  Numbers between n_1 and n_2 = $(n_2 - n_1 - 1)$

  (ii) Difference between odd numbers and prime numbers should be made clear by taking sufficient number of examples.

SECTION C

Questions number 16 to 25 carry 3 marks each.

16. Prove that $\sqrt{3}$ is an irrational number.

Ans. Let $\sqrt{3}$ be rational $\therefore \sqrt{3} = \frac{p}{q}$, p, q are integers, $q \neq 0$ and p, q are coprimes

$\therefore$ $p^2 = 3q^2 \Rightarrow 3$ divides $p^2 \Rightarrow 3$ divides p ...(*i*) 1 m

Let $p = 3a, a \in \text{I}$, we have $3q^2 = 9a^2 \Rightarrow q^2 = 3a^2$

$\therefore$ 3 divides $q^2 \Rightarrow$ 3 divides q ...(*ii*) 1 m

(i) and (ii) $\Rightarrow$ a contradiction, $\therefore$ $\sqrt{3}$ is not a rational number

Hence $\sqrt{3}$ is irrational 1 m

Performance

Marks	N.A.	0	½	1	1½	2	2½	3	Mean Score
Percentage	6	7	5	12	5	5	2	58	2.2

Quantitative Analysis

- A majority of students (60%) had given almost correct answer.
- About 10% of the students made minor mistakes and so got 1½ or 2 marks.
- A few of them (17%) committed major errors and so could get ½ or 1 mark only.
- Only 13% of the students could not attempt the question.

Common Errors Committed by students

- Proof by contradiction is not clear in the minds of students e.g. they are writing as:

  Let $\sqrt{3}$ be rational

  $\Rightarrow$ $\sqrt{3} = \frac{p}{q}$, (p, q are coprimes)

  $\Rightarrow$ $p = \sqrt{3}\,q$ which is a contradiction so, $\sqrt{3}$ is irrational

- Concept of coprime is also not well understood by the students.

Suggestive Remedial Measures

- Sufficient practice should be given by taking examples to use

(i) proof by contradiction.

(ii) proof by negation etc.

- Difference between primes and coprimes should be made clear by taking different examples.
- The result, "If 2 is a factor of p^2 then 2 is also a factor of p" should be clarified by taking examples.

17. Use Euclid's Division Lemma to show that the square of any positive integer is either of the form 3m or 3m + 1 for some integer m.

Ans. Let x be any positive integer, then it is of the

form $3q$, $3q + 1$ or $3q + 2$ ½ m

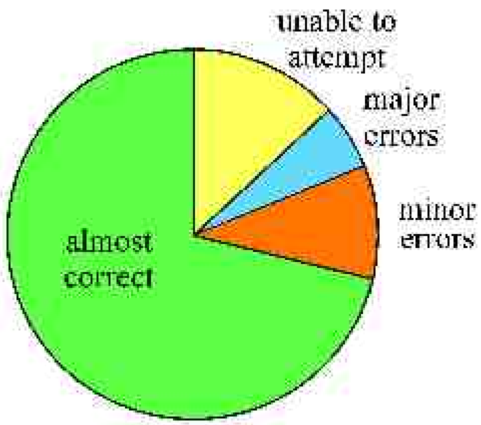
$\therefore \quad x^2 = (3q)^2 = 3\,(3q^2) = 3\text{m}$ ½ m

or $\quad x^2 = (3q + 1)^2 = 3\,(3q^2 + 2q) + 1 = 3\text{m} + 1$ 1 m

or $\quad x^2 = (3q + 2)^2 = 3\,(3q^2 + 4q + 1) + 1 = 3\text{m} + 1$ 1 m

Performance

Marks	N.A.	0	½	1	1½	2	2½	3	Mean Score
Percentage	7	6	1	5	2	8	1	70	2.5



Quantitative Analysis

- Majority of students (71%) solved the question correcty and got almost full marks.
- About 10% of the students committed minor mistakes and got 1½ or 2 marks.

- Only 6% of the students made major errors and could not score more than 1 mark.
- 13% of the students could not attempt the question.

Common Errors Committed by students

- "Any positive integer can be written as 3q, 3q + 1 or 3q + 2 for some integer q." was not clear to some of the students, so they could not start the solution of this question.
- Using Euclid's lemma to write the square of a number as

  $(3q)^2 = 9q^2 = 3\ (3q^2) = 3m$

  $(3q + 1)^2 = 9q^2 + 6q + 1 = 3\ (3q^2 + 2q) + 1 = 3m + 1,$

  $(3q + 2)^2 = 9q^2 + 12q + 3 + 1 = 3(3q^2 + 4q + 1) + 1 = 3m + 1$

  was difficult for some of the students & they made mistakes in writing in that form.

Suggestive Remedial Errors

- Sufficient practice to write $a = bq + r, \quad 0 \le r < b,$ has to be

  given, when a number a is to be divided by another number b, e.g.

  a number x can be written as

  (i) $x = 2m$ or $2m + 1$

  (ii) $x = 3m, 3m + 1, 3m + 2$

  (iii) $x = 4m, 4m + 1, 4m + 2, 4m + 3$ etc:
- Practice should be given so that students can identify that the operations + and × on integers lead to an integer.

18. The sum of the 4th and 8th terms of an A.P. is 24 and the sum of the 6th and 10th terms is 44. Find the first three terms of the A.P.

Ans. $a_4 + a_8 = 24 \Rightarrow a + 3d + a + 7d = 24 \Rightarrow a + 5d = 12$ 1 m

$a_6 + a_{10} = 44 \Rightarrow a + 5d + a + 9d = 44 \Rightarrow a + 7d = 22$ ½ m

Solving to get $a = -13$, $d = 5$ ½ m

$\therefore \quad a_1 = -13,\ a_2 = -8,\ a_3 = -3$ 1 m