

**MID-TERM EXAMINATION — Class 10 Mathematics (Set 4)****Chapters:** Real Numbers, Polynomials, Linear Equations, Triangles, Coordinate Geometry, Circles, Areas Related to Circles, Trigonometry & its Applications**Max
Marks: 80****Name:** _____**Time: 2 Hours****General Instructions:** All questions are compulsory. Five sections — A (20×1), B (5×2), C (6×3), D (4×5), E (3×4, case-studies). Draw neat figures where required. Take $\pi = \frac{22}{7}$ unless stated otherwise.**SECTION A**

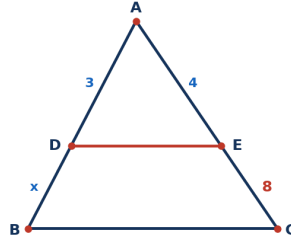
Multiple Choice / Assertion-Reason — 1 mark each

- Q1.** The number $2 \times 3 \times 5 \times 7 + 7$ is: [1]
(a) a prime number
(b) a composite number
(c) neither prime nor composite
(d) an odd prime
- Q2.** The exponent of 2 in the prime factorisation of 96 is: [1]
(a) 3
(b) 4
(c) 5
(d) 6
- Q3.** The product of the zeroes of $4x^2 - 8x + 3$ is: [1]
(a) $\frac{3}{4}$
(b) 2
(c) $-\frac{3}{4}$
(d) $\frac{8}{3}$
- Q4.** A quadratic polynomial whose zeroes are 0 and 5 is: [1]
(a) $x^2 - 5x$
(b) $x^2 + 5x$
(c) $x^2 - 5$
(d) $x^2 + 5$
- Q5.** The pair of equations $2x + 3y = 8$ and $4x + 6y = 7$ has: [1]
(a) a unique solution
(b) no solution
(c) infinitely many solutions
(d) exactly two solutions
- Q6.** The mid-point of the segment joining (7, 4) and (−3, 2) is: [1]
(a) (2, 3)
(b) (5, 3)
(c) (2, 6)
(d) (4, 3)
- Q7.** The distance between the points (5, −2) and (−1, −2) is: [1]
(a) 4
(b) 6
(c) 7

(d) 3

- Q8.** If $\triangle ABC \sim \triangle PQR$ with $AB = 6$, $PQ = 9$ and $\text{ar}(\triangle ABC) = 48 \text{ cm}^2$, then $\text{ar}(\triangle PQR) =$ [1]
- (a) 72 cm^2
(b) 108 cm^2
(c) 96 cm^2
(d) 144 cm^2

- Q9.** In the figure, $DE \parallel BC$ with $AD = 3$, $AE = 4$, $EC = 8$. Then $DB =$ [1]



- (a) 5
(b) 6
(c) 7
(d) 8
- Q10.** The length of the tangent from a point 17 cm from the centre of a circle of radius 8 cm is: [1]
- (a) 9 cm
(b) 15 cm
(c) 25 cm
(d) $\sqrt{353}$ cm
- Q11.** The value of $\sin^2 60^\circ + \cos^2 60^\circ$ is: [1]
- (a) 0
(b) 1
(c) $\frac{3}{4}$
(d) $\frac{1}{4}$
- Q12.** The value of $\tan 30^\circ \cdot \tan 60^\circ$ is: [1]
- (a) 0
(b) 1
(c) $\sqrt{3}$
(d) $\frac{1}{\sqrt{3}}$
- Q13.** If $\cos \theta = \frac{\sqrt{3}}{2}$, then $\theta =$ [1]
- (a) 30°
(b) 45°
(c) 60°
(d) 90°
- Q14.** The angle of elevation of the sun when the shadow of a pole is $\sqrt{3}$ times its height is: [1]
- (a) 30°
(b) 45°
(c) 60°
(d) 90°
- Q15.** The circumference of a circle of radius 10.5 cm is: [1]

- (a) 33 cm
- (b) 66 cm
- (c) 132 cm
- (d) 44 cm

Q16. The area of a sector of a circle of radius 10 cm and angle 90° is ($\pi = 3.14$): [1]

- (a) 78.5 cm^2
- (b) 157 cm^2
- (c) 31.4 cm^2
- (d) 314 cm^2

Q17. If $a = 2^3 \times 3^2$ and $b = 2^2 \times 3^3$, then $\text{HCF}(a, b) =$ [1]

- (a) 6
- (b) 36
- (c) 72
- (d) 216

Q18. The zeroes of the polynomial $x^2 - 5x$ are: [1]

- (a) 0, 5
- (b) 0, -5
- (c) 5, -5
- (d) 1, 5

Q19. **Assertion (A):** $\frac{1}{7}$ has a non-terminating repeating decimal expansion. [1]

Reason (R): The denominator 7 cannot be written in the form $2^m 5^n$.

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

Q20. **Assertion (A):** The mid-point of (2, 3) and (4, 5) is (3, 4). [1]

Reason (R): The mid-point of $(x_1, y_1), (x_2, y_2)$ is $(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2})$.

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

SECTION B

Very Short Answer — 2 marks each

Q21. Find the HCF and LCM of 90 and 144, and verify that $\text{HCF} \times \text{LCM} = \text{product of the numbers}$. [2]

Q22. Find a quadratic polynomial whose zeroes are $6 + \sqrt{5}$ and $6 - \sqrt{5}$. [2]

Q23. Solve the pair of equations: $4x + 3y = 8$ and $6x - 4y = -5$. [2]

Q24. In $\triangle ABC$, $DE \parallel BC$ with $AD = 2$ cm, $AB = 6$ cm and $AC = 9$ cm. Find AE . [2]

Q25. Prove that $(\sin A + \cos A)^2 + (\sin A - \cos A)^2 = 2$. [2]

SECTION C

Short Answer — 3 marks each

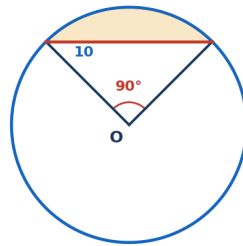
Q26. Prove that $3 + 2\sqrt{5}$ is irrational. [3]

- Q27.** Find the zeroes of $x^2 - (\sqrt{3} + 1)x + \sqrt{3}$ and verify the relationship between the zeroes and the coefficients. [3]
- Q28.** 2 women and 5 men can together finish a piece of embroidery in 4 days, while 3 women and 6 men can finish it in 3 days. Find the time taken by 1 woman alone and by 1 man alone to finish the work. [3]
- Q29.** Prove that the lengths of tangents drawn from an external point to a circle are equal. [3]
- Q30.** Find the area of the triangle whose vertices are $(2, 3)$, $(-1, 0)$ and $(2, -4)$. [3]
- Q31.** Prove that $\sqrt{\frac{1 - \cos A}{1 + \cos A}} = \csc A - \cot A$. [3]

SECTION D

Long Answer — 5 marks each

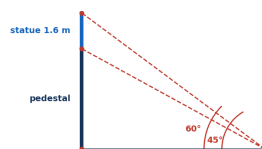
- Q32. Prove the Pythagoras Theorem:** In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides. [5]
- Q33.** The sum of the squares of two consecutive odd positive integers is 394. Find the integers. [5]
- Q34.** A man standing on the deck of a ship, 10 m above the water level, observes the angle of elevation of the top of a cliff as 45° and the angle of depression of its base as 30° . Find the height of the cliff and the distance of the ship from the cliff. (Use $\sqrt{3} = 1.73$) [5]
- Q35.** A chord of a circle of radius 10 cm subtends a right angle at the centre. Find the area of the corresponding minor segment and the major segment. (Use $\pi = 3.14$) [5]



SECTION E

Case-Study Based — 4 marks each

- Q36. Right-angled plot.** Three corners of a plot are marked at $A(1, 2)$, $B(5, 2)$ and $C(5, 6)$ on a coordinate grid (units in metres). [4]
- (i) Find the length AB . [1]
- (ii) Find the length BC . [1]
- (iii) Find AC and the area of the right triangle ABC . [2]
- Q37. Statue on a pedestal.** A statue 1.6 m tall stands on the top of a pedestal. From a point on the ground, the angle of elevation of the top of the statue is 60° and the angle of elevation of the top of the pedestal is 45° . [4]



- (i) Write the relation between the pedestal height h and the distance d from the 45° angle. [1]
- (ii) Find the height of the pedestal. [2]
- (iii) Find the distance of the point from the pedestal. (Use $\sqrt{3} = 1.73$) [1]
- Q38. Grazing horse.** A horse is tied to a corner of a square field with a rope. It grazes over a quarter-circle region. (Use $\pi = \frac{22}{7}$) [4]
- (i) Find the area grazed if the rope is 7 m long. [1]

(ii) Find the area grazed if the rope is **14** m long.

[1]

(iii) Find the increase in grazing area when the rope is lengthened from **7** m to **14** m.

[2]

— All the Best! —

ANSWER KEY & MARKING SCHEME

SECTION A

Answers

Q1. (b) a composite number

Q2. (c) 5

Q3. (a) $\frac{3}{4}$

Q4. (a) $x^2 - 5x$

Q5. (b) no solution

Q6. (a) (2, 3)

Q7. (b) 6

Q8. (b) 108 cm^2

Q9. (b) $6 \left[\frac{3}{DB} = \frac{4}{8} \right]$

Q10. (b) 15 cm

Q11. (b) 1

Q12. (b) 1

Q13. (a) 30°

Q14. (a) 30°

Q15. (b) 66 cm

Q16. (a) 78.5 cm^2

Q17. (b) 36

Q18. (a) 0, 5

SECTION B

Answers

Q19. $90 = 2 \cdot 3^2 \cdot 5$, $144 = 2^4 \cdot 3^2$. HCF = $2 \cdot 3^2 = 18$, LCM = $2^4 \cdot 3^2 \cdot 5 = 720$. Check $18 \times 720 = 12960 = 90 \times 144$. Verified.

Q20. Sum = 12, product = $36 - 5 = 31$. Polynomial: $x^2 - 12x + 31$.

Q21. $4x + 3y = 8$, $6x - 4y = -5 \Rightarrow 16x + 12y = 32$, $18x - 12y = -15$; adding $34x = 17 \Rightarrow x = \frac{1}{2}$, then $y = 2$.

Q22. $\frac{AD}{AB} = \frac{AE}{AC} \Rightarrow \frac{26}{6} = \frac{AE}{9} \Rightarrow AE = 3 \text{ cm}$.

Q23. $=(\sin^2 A + 2\sin A \cos A + \cos^2 A) + (\sin^2 A - 2\sin A \cos A + \cos^2 A) = 1 + 1 = 2$. Proved.

SECTION C

Answers

Q24. If $3 + 2\sqrt{5} = r$ (rational), then $\sqrt{5} = \frac{r-3}{2}$ is rational — contradiction. Hence $3 + 2\sqrt{5}$ is irrational.

Q25. $x^2 - (\sqrt{3} + 1)x + \sqrt{3} = (x - \sqrt{3})(x - 1)$; zeroes = $\sqrt{3}$, 1. Sum = $\sqrt{3} + 1 = -\frac{a}{b}$; product = $\sqrt{3} = \frac{c}{a}$. Verified.

Q26. Let woman's 1-day work = w , man's = m : $4(2w + 5m) = 1$ and $3(3w + 6m) = 1$. Solving, $w = \frac{1}{18}$, $m = \frac{1}{36}$. So a woman alone takes 18 days and a man alone 36 days.

Q27. With centre O and external point P : $\triangle OAP \cong \triangle OBP$ (RHS: $OA = OB$, $\angle A = \angle B = 90^\circ$, OP common) $\Rightarrow PA = PB$.

Q28. Area = $\frac{1}{2} |2(0 + 4) + (-1)(-4 - 3) + 2(3 - 0)| = \frac{1}{2} |8 + 7 + 6| = \frac{1}{2} \cdot 21 = 10.5 \text{ sq. units}$.

Q29. $\sqrt{1 - \cos A} + \cos A = \sqrt{1 - \cos A} \cdot 1 - \cos^2 A = \frac{1 - \cos A}{1 + \cos A} = \frac{1 - \cos A}{1 + \cos A}$. Proved.

SECTION D

Answers

Q30. Given right $\triangle ABC$, right-angled at B ; draw $BD \perp AC$. Then $\triangle ADB \sim \triangle ABC \Rightarrow AB^2 = AD \cdot AC$, and

$\triangle BDC \sim \triangle ABC \Rightarrow BC^2 = DC \cdot AC$. Adding: $AB^2 + BC^2 = AC(AD + DC) = AC^2$.

- Q31.** Let integers be $n, n + 2$:
 $n^2 + (n + 2)^2 = 394 \Rightarrow 2n^2 + 4n - 390 = 0 \Rightarrow n^2 + 2n - 195 = 0 \Rightarrow (n - 13)(n + 15) = 0 \Rightarrow n = 13$.
 Integers are **13** and **15**.
- Q32.** Depression of base 30° : $\tan 30^\circ = \frac{10}{d} \Rightarrow d = 10\sqrt{3} \approx 17.3$ m. Elevation of top 45° :
 $\tan 45^\circ = \frac{H - 10}{d} \Rightarrow H - 10 = 10\sqrt{3} \Rightarrow H = 10(1 + \sqrt{3}) \approx 27.3$ m. Distance
 $= 10\sqrt{3} \approx 17.3$ m.
- Q33.** Sector $(90^\circ) = \frac{14 \times 3.14 \times 100}{2} = 78.5$; triangle $= \frac{12 \times 10 \times 10}{2} = 50$. Minor segment
 $= 78.5 - 50 = 28.5 \text{ cm}^2$; major $= 3.14 \times 100 - 28.5 = 285.5 \text{ cm}^2$.

SECTION E

Answers

- Q34.** (i) $AB = 4$ m.
 (ii) $BC = 4$ m.
 (iii) $AC = \sqrt{4^2 + 4^2} = 4\sqrt{2}$ m; area $= \frac{1}{2} \times 4 \times 4 = 8 \text{ m}^2$ (right-angled at B).
- Q35.** (i) From 45° : $\tan 45^\circ = \frac{d}{h} \Rightarrow d = h$.
 (ii) From 60° :
 $\frac{d}{h} + 1.6 = \sqrt{3} \Rightarrow \frac{d}{h} + 1.6 = \sqrt{3}, h \Rightarrow \frac{d}{h} = \sqrt{3} - 1 = 0.8(\sqrt{3} + 1) \approx 2.19$ m.
 (iii) Distance $= d \approx 2.19$ m.
- Q36.** (i) Quarter circle $= \frac{1}{4} \times \frac{22}{7} \times 14^2 = 38.5 \text{ m}^2$.
 (ii) $\frac{1}{4} \times \frac{22}{7} \times 14^2 = 154 \text{ m}^2$.
 (iii) Increase $= 154 - 38.5 = 115.5 \text{ m}^2$.