

**MID-TERM EXAMINATION — Class 10 Mathematics (Set 2)**

**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

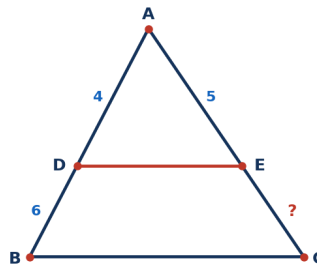
- Q1.** The HCF of the smallest composite number and the smallest prime number is: [1]
- (a) 1  
(b) 2  
(c) 4  
(d) 6
- 
- Q2.** For every natural number  $n$ , the number  $5^n$  always ends in the digit: [1]
- (a) 0  
(b) 2  
(c) 5  
(d) 6
- 
- Q3.** The zeroes of the polynomial  $x^2 - 4$  are: [1]
- (a) 2, -2  
(b) 4, -4  
(c) 2, 4  
(d) 0, 4
- 
- Q4.** If  $\alpha, \beta$  are the zeroes of  $x^2 + 5x + 6$ , then  $\alpha + \beta =$  [1]
- (a) 5  
(b) -5  
(c) 6  
(d) -6
- 
- Q5.** The pair of lines  $2x + 3y = 7$  and  $4x + 6y = 14$  is: [1]
- (a) intersecting  
(b) parallel  
(c) coincident  
(d) none

- Q6.** The value of  $x$  in the solution of  $x + y = 5$ ,  $x - y = 1$  is: [1]
- (a) 2  
(b) 3  
(c) 4  
(d) 1

- Q7.** The distance between the origin and the point  $(3, 4)$  is: [1]
- (a) 5  
(b) 7  
(c)  $\sqrt{7}$   
(d) 1

- Q8.** The point dividing the join of  $(1, 2)$  and  $(4, 5)$  internally in the ratio  $1 : 2$  is: [1]
- (a)  $(2, 3)$   
(b)  $(3, 4)$   
(c)  $(2, 4)$   
(d)  $(3, 3)$

- Q9.** In the figure,  $DE \parallel BC$  with  $AD = 4$ ,  $DB = 6$ ,  $AE = 5$ . Then  $EC =$  [1]



- (a) 6  
(b) 7.5  
(c) 8  
(d) 9
- Q10.** The ratio of the areas of two similar triangles is  $25 : 36$ . The ratio of their corresponding sides is: [1]
- (a)  $5 : 6$   
(b)  $25 : 36$   
(c)  $6 : 5$   
(d)  $625 : 1296$
- Q11.** The length of the tangent from a point 5 cm from the centre of a circle of radius 3 cm is: [1]
- (a) 3 cm  
(b) 4 cm  
(c) 5 cm  
(d) 8 cm
- Q12.** The length of the tangent from a point 13 cm from the centre of a circle of radius 5 cm is: [1]
- (a) 12 cm  
(b) 8 cm  
(c) 18 cm

(d)  $\sqrt{194}$  cm

**Q13.** The value of  $\cos^2 30^\circ + \sin^2 30^\circ$  is:

[1]

- (a) 0
- (b) 1
- (c)  $\frac{1}{2}$
- (d)  $\sqrt{3}$

**Q14.** If  $\tan \theta = 1$ , then  $\theta =$

[1]

- (a)  $30^\circ$
- (b)  $45^\circ$
- (c)  $60^\circ$
- (d)  $90^\circ$

**Q15.** The value of  $\sec^2 45^\circ - \tan^2 45^\circ$  is:

[1]

- (a) 0
- (b) 1
- (c) 2
- (d)  $\frac{1}{2}$

**Q16.** A pole 6 m high casts a shadow  $2\sqrt{3}$  m long. The angle of elevation of the sun is:

[1]

- (a)  $30^\circ$
- (b)  $45^\circ$
- (c)  $60^\circ$
- (d)  $90^\circ$

**Q17.** The perimeter of a semicircle of radius 7 cm is:

[1]

- (a) 22 cm
- (b) 36 cm
- (c) 44 cm
- (d) 14 cm

**Q18.** The area of a quadrant of a circle of radius 14 cm is:

[1]

- (a)  $77 \text{ cm}^2$
- (b)  $154 \text{ cm}^2$
- (c)  $308 \text{ cm}^2$
- (d)  $616 \text{ cm}^2$

**Q19. Assertion (A):**  $\sqrt{2} + \sqrt{3}$  is an irrational number.

[1]

**Reason (R):** The sum of any two irrational numbers is always irrational.

- (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 point (3, 0) lies on the  $x$ -axis.

[1]

**Reason (R):** The  $y$ -coordinate of every point on the  $x$ -axis is 0.

- (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 of **336** and **54** by prime factorisation. [2]
- Q22.** Find a quadratic polynomial whose zeroes are  $5 + \sqrt{2}$  and  $5 - \sqrt{2}$ . [2]
- Q23.** Solve the pair of equations:  $2x + 3y = 11$  and  $2x - 4y = -24$ . [2]
- Q24.** In  $\triangle ABC$ ,  $DE \parallel BC$  with  $AD = x$ ,  $DB = x - 2$ ,  $AE = x + 2$ ,  $EC = x - 1$ . Find  $x$ . [2]
- Q25.** Evaluate:  $\sin 30^\circ \cos 60^\circ + \cos 30^\circ \sin 60^\circ$ . [2]

## SECTION C

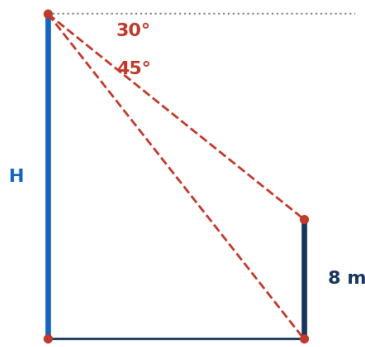
Short Answer — 3 marks each

- Q26.** Prove that  $\sqrt{2}$  is an irrational number. [3]
- Q27.** Find the zeroes of  $2x^2 - x - 6$  and verify the relationship between the zeroes and the coefficients. [3]
- Q28.** The sum of a two-digit number and the number obtained by reversing its digits is **66**. If the digits of the number differ by **2**, find the number. [3]
- Q29.** A quadrilateral  $ABCD$  is drawn to circumscribe a circle. Prove that  $AB + CD = AD + BC$ . [3]
- Q30.** Find the coordinates of the point  $P$  which divides the segment joining  $A(-2, -2)$  and  $B(2, -4)$  such that  $AP = \frac{3}{7}AB$ . [3]
- Q31.** Prove that  $(\csc \theta - \cot \theta)^2 = \frac{1 - \cos \theta}{1 + \cos \theta}$ . [3]

## SECTION D

Long Answer — 5 marks each

- Q32. Prove the Converse of the Basic Proportionality Theorem:** If a line divides any two sides of a triangle in the same ratio, then the line is parallel to the third side. [5]
- Q33.** Two water taps together can fill a tank in  $9\frac{3}{8}$  hours. The tap of larger diameter takes **10** hours less than the smaller one to fill the tank separately. Find the time in which each tap can fill the tank. [5]
- Q34.** The angles of depression of the top and the bottom of an **8** m tall building from the top of a multi-storeyed building are  $30^\circ$  and  $45^\circ$  respectively. Find the height of the multi-storeyed building and the horizontal distance between the two buildings. (Use  $\sqrt{3} = 1.73$ ) [5]

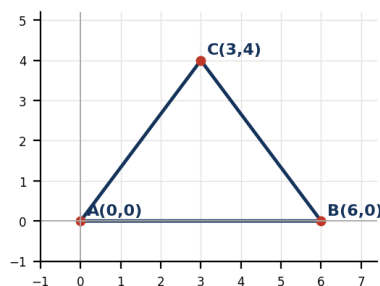


- Q35.** A chord of a circle of radius **15** cm subtends an angle of **60°** at the centre. Find the areas of the minor and major segments. (Use  $\pi = 3.14$ ,  $\sqrt{3} = 1.73$ ) [5]

## SECTION E

Case-Study Based — 4 marks each

- Q36. Triangular park.** A triangular park has its corners at  $A(0,0)$ ,  $B(6,0)$  and  $C(3,4)$  on a coordinate grid (units in metres). [4]



- (i) Find the length  $AB$ . [1]
  - (ii) Find the length  $AC$ . [1]
  - (iii) Find the perimeter of the park and state whether it is isosceles. [2]
- Q37. Wheelchair ramp.** A ramp is built making an angle of **30°** with the horizontal ground; the horizontal base of the ramp is **6** m long. [4]
- (i) Find the vertical height raised by the ramp. [1]
  - (ii) Find the length of the sloping ramp surface. [2]
  - (iii) If the same base were used with a **45°** ramp, what height would be raised? [1]
- Q38. Round table cover.** A circular table cover of radius **21** cm has a design of **6** equal sectors around its centre. [4]
- (i) Find the total area of the table cover. [1]
  - (ii) Find the area of one sector (**60°**). [1]
  - (iii) Find the length of the arc of one such sector. [2]

— All the Best! —

## ANSWER KEY & MARKING SCHEME

### SECTION A

Answers

- Q1. (b) 2
- Q2. (c) 5
- Q3. (a) 2, -2
- Q4. (b) -5
- Q5. (c) coincident
- Q6. (b) 3
- Q7. (a) 5
- Q8. (a) (2, 3)
- Q9. (b) 7.5 [ $\frac{4}{6} = \frac{5}{EC}$ ]
- Q10. (a) 5 : 6
- Q11. (b) 4 cm
- Q12. (a) 12 cm
- Q13. (b) 1
- Q14. (b)  $45^\circ$
- Q15. (b) 1
- Q16. (c)  $60^\circ$
- Q17. (b) 36 cm
- Q18. (b)  $154 \text{ cm}^2$
- Q19. (c) A true, R false
- Q20. (a) Both true, R explains A

### SECTION B

Answers

- Q21.  $336 = 2^4 \times 3 \times 7$ ,  $54 = 2 \times 3^3$ . HCF =  $2 \times 3 = 6$ .
- Q22. Sum = 10, product =  $25 - 2 = 23$ . Polynomial:  $x^2 - 10x + 23$ .
- Q23. Subtracting:  $7y = 35 \Rightarrow y = 5$ ; then  $2x = 11 - 15 \Rightarrow x = -2$ .
- Q24.  $\frac{x}{x-2} = \frac{x+2}{x-1} \Rightarrow x(x-1) = (x+2)(x-2) \Rightarrow x^2 - x = x^2 - 4 \Rightarrow x = 4$ .
- Q25.  $= \sin(30^\circ + 60^\circ) = \sin 90^\circ = 1$ .

### SECTION C

Answers

- Q26. Assume  $\sqrt{2} = \frac{p}{q}$  (lowest terms)  $\Rightarrow 2q^2 = p^2 \Rightarrow 2 \mid p$ ; put  $p = 2m \Rightarrow q^2 = 2m^2 \Rightarrow 2 \mid q$ . Both even — contradiction.  
Hence  $\sqrt{2}$  is irrational.
- Q27.  $2x^2 - x - 6 = (2x + 3)(x - 2)$ ; zeroes = 2,  $-\frac{3}{2}$ . Sum =  $\frac{1}{2} = -\frac{-1}{2}$ , product =  $-3 = \frac{-6}{2}$ . Verified.
- Q28. Let digits be  $t, u$ :  $11(t + u) = 66 \Rightarrow t + u = 6$ ; and  $|t - u| = 2 \Rightarrow$  digits 4 and 2. The number is 42 (or 24).

**Q29.** Tangents from a point are equal:  $AP = AS$ ,  $BP = BQ$ ,  $CR = CQ$ ,  $DR = DS$ . Adding round:  
 $AB + CD = (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ) = AD + BC$ .

**Q30.** Ratio  $AP : PB = 3 : 4$ .  $P = \left( \frac{3(2) + 4(-2)}{7}, \frac{3(-4) + 4(-2)}{7} \right) = \left( -\frac{2}{7}, -\frac{20}{7} \right)$ .

**Q31.** LHS =  $\left( \frac{1 - \cos \theta}{\sin \theta} \right)^2 = \frac{(1 - \cos \theta)^2}{1 - \cos^2 \theta} = \frac{(1 - \cos \theta)^2}{(1 - \cos \theta)(1 + \cos \theta)} = \frac{1 - \cos \theta}{1 + \cos \theta}$ . Proved.

## SECTION D

Answers

**Q32.** Given  $\frac{AD}{DB} = \frac{AE}{EC}$  in  $\triangle ABC$ . If  $DE$  were not  $\parallel BC$ , draw  $DE' \parallel BC$ . By BPT  $\frac{AD}{DB} = \frac{AE'}{E'C}$ , so  
 $\frac{AE}{EC} = \frac{AE'}{E'C} \Rightarrow E = E'$ . Hence  $DE \parallel BC$ .

**Q33.** Let smaller tap take  $x$  h, larger  $(x - 10)$  h.  
 $\frac{1}{x} + \frac{1}{x - 10} = \frac{8}{75} \Rightarrow 75(2x - 10) = 8x(x - 10) \Rightarrow 8x^2 - 230x + 750 = 0 \Rightarrow 4x^2 - 115x + 375 = 0 \Rightarrow x = 25$ .  
 Smaller = 25 h, larger = 15 h.

**Q34.** Let  $H$  = height,  $d$  = distance. Bottom ( $45^\circ$ ):  $d = H$ . Top ( $30^\circ$ ):  
 $\frac{1}{\sqrt{3}} = \frac{H - 8}{H} \Rightarrow H(\sqrt{3} - 1) = 8\sqrt{3} \Rightarrow H = 4(3 + \sqrt{3}) = 12 + 4\sqrt{3} \approx 18.93$  m; distance =  $H \approx 18.93$  m.

**Q35.** Sector =  $\frac{60}{360} \times 3.14 \times 225 = 117.75$ ; equilateral  $\triangle = \frac{\sqrt{3}}{4} \times 225 = 97.31$ . Minor segment  
 $= 117.75 - 97.31 = 20.44$  cm<sup>2</sup>; major =  $3.14 \times 225 - 20.44 = 686.06$  cm<sup>2</sup>.

## SECTION E

Answers

**Q36.** (i)  $AB = 6$  m.  
 (ii)  $AC = \sqrt{9 + 16} = 5$  m.  
 (iii)  $BC = \sqrt{9 + 16} = 5$  m; perimeter =  $6 + 5 + 5 = 16$  m; since  $AC = BC$ , the park is isosceles.

**Q37.** (i) Height =  $6 \tan 30^\circ = 2\sqrt{3} \approx 3.46$  m.  
 (ii) Length =  $6 \cos 30^\circ = 3\sqrt{3} \approx 5.19$  m.  
 (iii) Height =  $6 \tan 45^\circ = 6$  m.

**Q38.** (i) Area =  $\frac{227 \times 21^2}{2} = 1386$  cm<sup>2</sup>.  
 (ii) One sector =  $\frac{1386}{6} = 231$  cm<sup>2</sup>.  
 (iii) Arc =  $\frac{60}{360} \times 2 \times \frac{227 \times 21}{2} = 22$  cm.