# TALLENTEX Mathematics

## Sample Paper – 6

**Duration: 23 Minutes** **Maximum Marks: 60**

### Instructions

- This paper contains **15 MCQ** questions with a **single correct answer**, modelled on the Mathematics portion of **TALLENTEX**.
- Marking scheme: **+4** for correct answer, **−1** for incorrect answer, **0** for unattempted.
- Only **one** option is correct for each question.
- Syllabus: **NCERT Class 8 and Class 9 Mathematics**.
- **No** mobile phones, calculators, or electronic gadgets are allowed in the examination hall.

**Q1.** Which of the following is NOT an irrational number?

(A) $2 + \sqrt{3}$

(B) $\sqrt{4} + \sqrt{9}$

(C) $\sqrt{2} \times \sqrt{3}$

(D) $\dfrac{\pi}{2}$

**Q2.** When $p(x) = x^3 + 3x^2 - 2x + 5$ is divided by $(x - 1)$, the remainder is:

(A) $5$

(B) $6$

(C) $7$

(D) $8$

**Q3.** 12 workers can complete a task in 10 days. How many days will 8 workers take to complete the same task?

(A) $12$ days

(B) $13$ days

(C) $14$ days

(D) $15$ days

**Q4.** A shop offers two successive discounts of $20\%$ and $10\%$ on an article marked at Rs. 1000. Find the final selling price.

(A) Rs. 720

(B) Rs. 730

(C) Rs. 750

(D) Rs. 770

**Q5.** Factorise $8x^3 + 27y^3$.

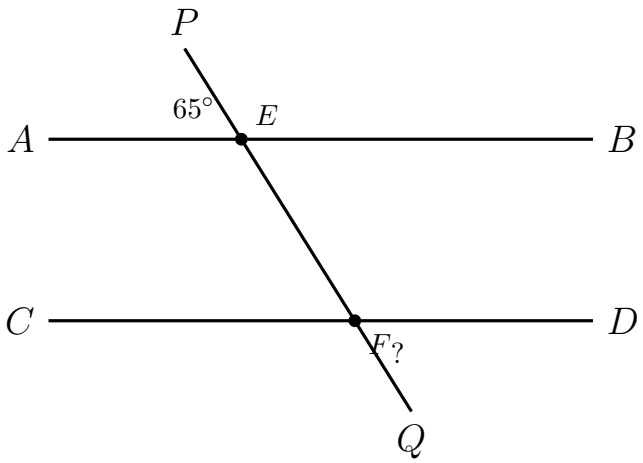
(A) $(2x + 3y)(4x^2 + 6xy + 9y^2)$

(B) $(2x + 3y)(4x^2 - 6xy + 9y^2)$

(C) $(2x - 3y)(4x^2 + 6xy + 9y^2)$

(D) $(2x - 3y)(4x^2 - 6xy + 9y^2)$

**Q6.** In the figure, $AB \parallel CD$ and a transversal $PQ$ cuts them at $E$ and $F$ respectively. If $\angle AEF = 65^\circ$, find $\angle EFD$.




(A) $55^\circ$

(B) $65^\circ$

(C) $115^\circ$

(D) $125^\circ$

**Q7.** In $\triangle ABC$, $D$ and $E$ are the midpoints of $AB$ and $AC$ respectively. If $DE = 4$ cm, find $BC$.

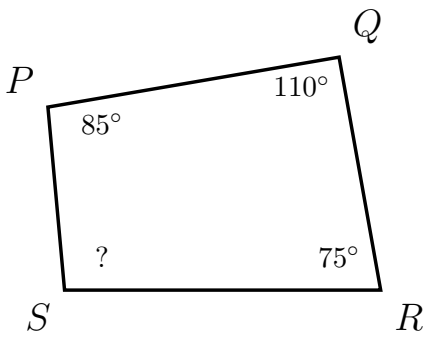
(A) $4$ cm

(B) $5$ cm

(C) $6$ cm

(D) $8$ cm

**Q8.** $PQRS$ is a quadrilateral. $\angle P = 85°$, $\angle Q = 110°$, $\angle R = 75°$. Find $\angle S$.



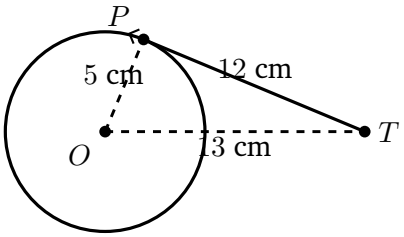

(A) $90°$

(B) $95°$

(C) $100°$

(D) $105°$

**Q9.** From an external point $T$, a tangent $TP$ is drawn to a circle with centre $O$ and radius $5$ cm. If $OT = 13$ cm, find the length of $TP$.




(A) $10$ cm

(B) $12$ cm

(C) $13$ cm

(D) $14$ cm

**Q10.** Find the area of a sector of a circle with radius $14$ cm and central angle $90°$. (Use $\pi = \frac{22}{7}$.)

(A) $142$ cm$^2$

(B) $148$ cm$^2$

(C) $154$ cm$^2$

(D) $160$ cm$^2$

**Q11.** Find the total surface area of a solid hemisphere of radius $7$ cm. (Use $\pi = \frac{22}{7}$.)

(A) $348$ cm$^2$

(B) $396$ cm$^2$

(C) $428$ cm$^2$

(D) $462$ cm$^2$

**Q12.** The marks of 5 students are $72,\ 85,\ 68,\ 90,\ 80$. Find the mean.

(A) $79$

(B) $80$

(C) $81$

(D) $82$

**Q13.** A letter is chosen at random from the word **MATHEMATICS**. What is the probability of choosing a vowel?

(A) $\frac{3}{11}$

(B) $\frac{4}{11}$

(C) $\frac{5}{11}$

(D) $\frac{6}{11}$

**Q14.** Find the area of the triangle with vertices $A(1,\ 2)$, $B(4,\ 6)$, and $C(4,\ 2)$.

(A) $4$ sq units

(B) $5$ sq units

(C) $6$ sq units

(D) $8$ sq units

**Q15.** Solve the system: $x + y = 10$ and $x - y = 4$. Find the value of $x$.

(A) $5$

(B) $6$

(C) $\frac{13}{2}$

(D) $7$

## Detailed Solutions

### Q1.

**Solution**

**Concept — Number Systems:** A number is rational if it can be written as $\frac{p}{q}$, where $p, q$ are integers and $q \neq 0$. Sums or products of irrational numbers are not always irrational.

**Step 1 — Evaluate option B.**

$$\sqrt{4} + \sqrt{9} = 2 + 3 = 5.$$

Since $5$ is an integer, it is rational. Hence option B is **NOT** irrational.

**Step 2 — Check remaining options.**

- Option A: $2 + \sqrt{3}$ is irrational (sum of a rational and an irrational number).
- Option C: $\sqrt{2} \times \sqrt{3} = \sqrt{6}$, which is irrational.
- Option D: $\frac{\pi}{2}$ is irrational (rational multiple of an irrational number).

**Why other options are wrong:** Options A, C, D are all irrational; only B simplifies to the rational number $5$.

**Final Answer:** $\sqrt{4} + \sqrt{9} = 5$ is rational $\Rightarrow$ $\boxed{\text{B}}$

**Answer: (B)** Go Back to Q 1

### Q2.

**Solution**

**Concept — Remainder Theorem:** When $p(x)$ is divided by $(x - a)$, the remainder is $p(a)$.

**Step 1 — Substitute $x = 1$ into $p(x) = x^3 + 3x^2 - 2x + 5$.**

$$p(1) = 1^3 + 3(1)^2 - 2(1) + 5 = 1 + 3 - 2 + 5 = 7.$$

**Why other options are wrong:**

- Option A: Remainder $5$ would require $p(1) = 5$ (incorrect).
- Option B: Remainder $6$ would require $p(1) = 6$ (incorrect).
- Option D: Remainder $8$ would require $p(1) = 8$ (incorrect).

**Final Answer:** remainder $= 7 \Rightarrow$ C

**Answer: (C)** Go Back to Q 2

## Q3.

### Solution

**Concept — Inverse Proportion (Time and Work):** When more workers do the work, fewer days are needed. This is inverse proportion: $W_1 \times D_1 = W_2 \times D_2$.

**Step 1 — Apply the formula.**

$$12 \times 10 = 8 \times d \implies d = \frac{120}{8} = 15 \text{ days}.$$

**Why other options are wrong:**

- Option A: $8 \times 12 = 96 \neq 120$.
- Option B: $8 \times 13 = 104 \neq 120$.
- Option C: $8 \times 14 = 112 \neq 120$.

**Final Answer:** $8$ workers take $15$ days $\Rightarrow$ D

**Answer: (D)** Go Back to Q 3

## Q4.

### Solution

**Concept — Successive Discounts:** With two successive discounts of $r_1\%$ and $r_2\%$, the effective price $=$ MP $\times \left(1 - \frac{r_1}{100}\right)\left(1 - \frac{r_2}{100}\right)$.

**Step 1 — Apply the first discount (20%).**

$$1000 \times 0.80 = \text{Rs. } 800.$$

**Step 2 — Apply the second discount (10%).**

$$800 \times 0.90 = \text{Rs. } 720.$$

**Why other options are wrong:**

- Option B: Rs. 730 is not obtained by standard successive-discount calculation.

- Option C: Rs. 750 equals a single flat $25\%$ discount (wrong; successive discounts compound).
- Option D: Rs. 770 ignores the compounding effect of the second discount.

**Final Answer:** Final price $=$ Rs. 720 $\Rightarrow$ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q 4

## Q5.

### Solution

**Concept — Sum of Cubes Identity:** $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$.

**Step 1 — Identify $a$ and $b$.** Write $8x^3 = (2x)^3$ and $27y^3 = (3y)^3$. So $a = 2x$, $b = 3y$.

**Step 2 — Expand using the identity.**

$$8x^3 + 27y^3 = (2x+3y)\big((2x)^2 - (2x)(3y) + (3y)^2\big) = (2x+3y)(4x^2 - 6xy + 9y^2).$$

**Why other options are wrong:**

- Option A: Uses $+6xy$ instead of $-6xy$; this would be part of $(a+b)^3$ expansion, not $a^3 + b^3$.
- Options C and D: Use $(2x - 3y)$, which arises from the *difference* of cubes $a^3 - b^3$, not the sum.

**Final Answer:** $(2x+3y)(4x^2 - 6xy + 9y^2) \Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q 5

## Q6.

### Solution

**Concept — Co-interior Angles:** When a transversal cuts two parallel lines, co-interior angles (also called same-side interior angles or co-interior angles) are supplementary, i.e., their sum $= 180°$.

**Step 1 — Identify the angle pair.** $\angle AEF$ and $\angle EFD$ are co-interior angles: they lie between the parallel lines $AB$ and $CD$, on the same side of the transversal $PQ$.

**Step 2 — Apply the property.**

$$\angle AEF + \angle EFD = 180° \implies 65° + \angle EFD = 180° \implies \angle EFD = 115°.$$

**Why other options are wrong:**

- Option A: $55^\circ$ would arise from complementary angles (sum $90^\circ$), not co-interior.
- Option B: $65^\circ$ is the alternate interior angle on the other side of $E$, not $\angle EFD$.
- Option D: $125^\circ$ is an arithmetic error ($180 - 65 = 115$, not $125$).

**Final Answer:** $\angle EFD = 115^\circ \Rightarrow$ C

**Answer: (C)** Go Back to Q 6

## Q7.

**Solution**

**Concept — Midpoint Theorem:** The line segment joining the midpoints of two sides of a triangle is parallel to the third side and equal to *half* its length.

**Step 1 — Apply the Midpoint Theorem.** $D$ and $E$ are the midpoints of $AB$ and $AC$ respectively. By the Midpoint Theorem:

$$DE = \frac{BC}{2}.$$

**Step 2 — Solve for $BC$.**

$$4 = \frac{BC}{2} \implies BC = 2 \times 4 = 8 \text{ cm}.$$

**Why other options are wrong:**

- Option A: $BC = 4$ cm treats $BC = DE$ (ignores the halving).
- Option B: $5$ cm and Option C: $6$ cm are numerically incorrect by direct calculation.

**Final Answer:** $BC = 8$ cm $\Rightarrow$ D

**Answer: (D)** Go Back to Q 7

## Q8.

**Solution**

**Concept — Angle Sum Property of a Quadrilateral:** The sum of all four interior angles of any quadrilateral $= 360°$.

**Step 1 — Set up the equation.**

$$\angle P + \angle Q + \angle R + \angle S = 360°.$$

**Step 2 — Substitute and solve.**

$$85° + 110° + 75° + \angle S = 360° \implies 270° + \angle S = 360° \implies \angle S = 90°.$$

**Why other options are wrong:**

- Option B: $95°$ gives a total sum of $365° \neq 360°$.
- Option C: $100°$ gives a total sum of $370° \neq 360°$.
- Option D: $105°$ gives a total sum of $375° \neq 360°$.

**Final Answer:** $\angle S = 90° \Rightarrow$ A

**Answer: (A)** Go Back to Q 8

## Q9.

**Solution**

**Concept — Tangent and Radius:** The tangent to a circle is perpendicular to the radius at the point of tangency. Therefore $\angle OPT = 90°$ and Pythagoras' theorem applies in $\triangle OPT$:

$$TP^2 = OT^2 - OP^2.$$

**Step 1 — Identify the known values.** $OP = r = 5$ cm (radius), $OT = 13$ cm.

**Step 2 — Apply Pythagoras' theorem.**

$$TP = \sqrt{OT^2 - OP^2} = \sqrt{13^2 - 5^2} = \sqrt{169 - 25} = \sqrt{144} = 12 \text{ cm}.$$

**Why other options are wrong:**

- Option A: $10$ cm gives $10^2 = 100 \neq 144$.
- Option C: $13$ cm is the length of $OT$, not the tangent $TP$.

- Option D: 14 cm gives $14^2 = 196 \neq 144$.

**Final Answer:** $TP = 12$ cm $\Rightarrow$ B

**Answer: (B)** Go Back to Q 9

## Q10.

### Solution

**Concept — Area of a Sector:** For a sector with radius $r$ and central angle $\theta°$:

$$\text{Area} = \frac{\theta}{360°} \times \pi r^2.$$

**Step 1 — Substitute the values.**

$$\text{Area} = \frac{90}{360} \times \frac{22}{7} \times 14^2 = \frac{1}{4} \times \frac{22}{7} \times 196 = \frac{1}{4} \times 22 \times 28 = \frac{1}{4} \times 616 = 154 \text{ cm}^2.$$

**Why other options are wrong:**

- Option A: 142 $\text{cm}^2$ is an arithmetic error.
- Option B: 148 $\text{cm}^2$ is an arithmetic error.
- Option D: 160 $\text{cm}^2$ arises from using an incorrect formula or value of $\pi$.

**Final Answer:** Area of sector $= 154$ $\text{cm}^2$ $\Rightarrow$ C

**Answer: (C)** Go Back to Q 10

## Q11.

### Solution

**Concept — Total Surface Area of a Solid Hemisphere:**

$$\text{TSA} = 2\pi r^2 \text{ (curved surface)} + \pi r^2 \text{ (flat circular base)} = 3\pi r^2.$$

**Step 1 — Substitute $r = 7$ cm.**

$$\text{TSA} = 3 \times \frac{22}{7} \times 7^2 = 3 \times \frac{22}{7} \times 49 = 3 \times 22 \times 7 = 3 \times 154 = 462 \text{ cm}^2.$$

**Why other options are wrong:**

- Option A: 348 $\text{cm}^2$ corresponds to approximately $2\pi r^2$ only (curved surface

area, missing the base).
- Option B: $396$ cm$^2$ is an arithmetic error.
- Option C: $428$ cm$^2$ is an arithmetic error.

**Final Answer:** TSA $= 462$ cm$^2$ $\Rightarrow$ $\boxed{\text{D}}$

**Answer: (D)** Go Back to Q 11

## Q12.

### Solution

**Concept — Mean:**

$$\text{Mean} = \frac{\text{Sum of all observations}}{\text{Number of observations}}.$$

**Step 1 — Find the sum.**

$$72 + 85 + 68 + 90 + 80 = 395.$$

**Step 2 — Divide by the number of observations (5).**

$$\text{Mean} = \frac{395}{5} = 79.$$

**Why other options are wrong:**

- Option B: $80$ would require sum $= 400 \neq 395$.
- Option C: $81$ would require sum $= 405 \neq 395$.
- Option D: $82$ would require sum $= 410 \neq 395$.

**Final Answer:** Mean $= 79$ $\Rightarrow$ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q 12

## Q13.

### Solution

**Concept — Probability:**

$$P(\text{event}) = \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}.$$

**Step 1 — Count total letters in MATHEMATICS.** M-A-T-H-E-M-A-T-I-C-S. Total

$= 11$ letters.

**Step 2 — Identify the vowels.** Vowels: A (position 2), E (position 5), A (position 7), I (position 9). Number of vowels $= 4$.

**Step 3 — Calculate probability.**

$$P(\text{vowel}) = \frac{4}{11}.$$

**Why other options are wrong:**

- Option A: $\frac{3}{11}$ counts only 3 vowels (missing one A or I).
- Option C: $\frac{5}{11}$ overcounts the vowels.
- Option D: $\frac{6}{11}$ overcounts further.

**Final Answer:** $P(\text{vowel}) = \frac{4}{11} \Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q 13

## Q14.

**Solution**

**Concept — Area of a Triangle (Coordinate Geometry):**

$$\text{Area} = \frac{1}{2}\left|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)\right|.$$

**Step 1 — Identify the vertices.** $A(1, 2)$, $B(4, 6)$, $C(4, 2)$.

**Step 2 — Substitute.**

$$\text{Area} = \frac{1}{2}\left|1(6-2) + 4(2-2) + 4(2-6)\right| = \frac{1}{2}\left|4 + 0 - 16\right| = \frac{1}{2} \times 12 = 6 \text{ sq units}.$$

*Alternative:* $B$ and $C$ share $x = 4$, so base $BC = |6-2| = 4$ units (vertical). Height from $A(1, 2)$ to line $x = 4$ is $|4 - 1| = 3$ units. Area $= \frac{1}{2} \times 4 \times 3 = 6$. ✓

**Why other options are wrong:**

- Option A: $4$ sq units — incorrect by direct calculation.
- Option B: $5$ sq units — incorrect by direct calculation.
- Option D: $8$ sq units — incorrect by direct calculation.

**Final Answer:** Area $= 6$ sq units $\Rightarrow$ C

**Answer: (C)** Go Back to Q 14

## Q15.

### Solution

**Concept — Elimination Method:** Add or subtract the two equations to eliminate one variable, then solve for the other.

**Step 1 — Write the equations.**

$$x + y = 10 \quad \ldots(1), \qquad x - y = 4 \quad \ldots(2).$$

**Step 2 — Add (1) and (2).**

$$(x + y) + (x - y) = 10 + 4 \implies 2x = 14 \implies x = 7.$$

**Step 3 — Find $y$ and verify.** From (1): $7 + y = 10 \Rightarrow y = 3$. Check in (2): $7 - 3 = 4$. ✓

**Why other options are wrong:**

- Option A: $x = 5$ gives $5 + y = 10 \Rightarrow y = 5$, but $5 - 5 = 0 \neq 4$.
- Option B: $x = 6$ gives $y = 4$, but $6 - 4 = 2 \neq 4$.
- Option C: $x = \frac{13}{2}$ gives $y = \frac{7}{2}$, but $\frac{13}{2} - \frac{7}{2} = 3 \neq 4$.

**Final Answer:** $x = 7 \Rightarrow$ D

**Answer: (D)** Go Back to Q 15

# Answer Key

| Q | Ans | Q | Ans | Q | Ans | Q | Ans | Q | Ans |
|---|---|---|---|---|---|---|---|---|---|
| 1 | B | 2 | C | 3 | D | 4 | A | 5 | B |
| 6 | C | 7 | D | 8 | A | 9 | B | 10 | C |
| 11 | D | 12 | A | 13 | B | 14 | C | 15 | D |