# TALLENTEX Mathematics

## Sample Paper – 10

**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 an **irrational** number?

(A) $\sqrt{4}$

(B) $\sqrt{7}$

(C) $\sqrt{9}$

(D) $\sqrt{16}$

**Q2.** Factorise: $x^3 - 8$.

(A) $(x+2)(x^2-2x+4)$

(B) $(x-2)(x^2-2x+4)$

(C) $(x-2)(x^2+2x+4)$

(D) $(x+2)(x^2+2x+4)$

**Q3.** Eight men can complete a piece of work in $12$ days. In how many days will $6$ men complete the same work?

(A) $8$ days

(B) $10$ days

(C) $14$ days

(D) $16$ days

**Q4.** A number is increased by $20\%$ and then decreased by $20\%$. What is the net percentage change in the number?

(A) $4\%$ decrease

(B) No change

(C) $4\%$ increase

(D) $2\%$ decrease

**Q5.** Using the identity $(a+b+c)^2 = a^2+b^2+c^2+2(ab+bc+ca)$, find the value of $(1+2+3)^2$.

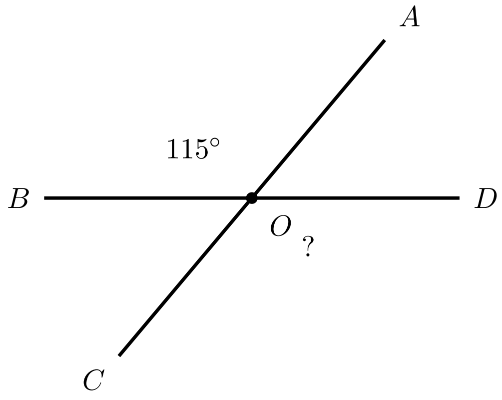
(A) $14$

(B) $36$

(C) $22$

(D) $24$

**Q6.** In the figure, two lines intersect at point $O$. If $\angle AOC = 115°$, find $\angle BOD$.



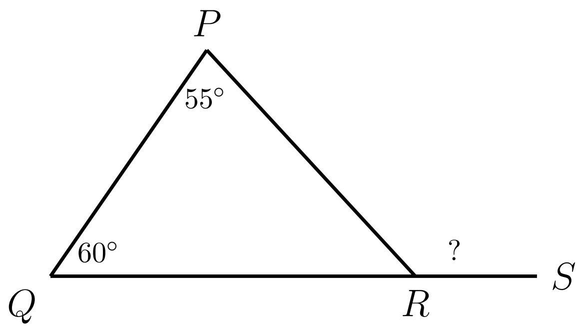

(A) $65°$

(B) $75°$

(C) $115°$

(D) $180°$

**Q7.** In the figure, side $QR$ of $\triangle PQR$ is extended to $S$. If $\angle QPR = 55°$ and $\angle PQR = 60°$, find $\angle PRS$.




(A) 55°

(B) 60°

(C) 65°

(D) 115°

**Q8.** In rectangle $PQRS$, the diagonals $PR$ and $QS$ intersect at $O$. If $PR = 26$ cm, find $OQ$.

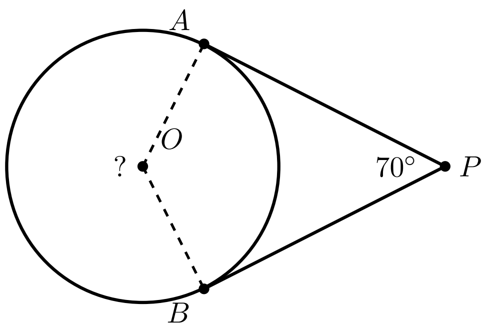
(A) 13 cm

(B) 17 cm

(C) 26 cm

(D) 52 cm

**Q9.** From an external point $P$, two tangents $PA$ and $PB$ are drawn to a circle with centre $O$. If $\angle APB = 70°$, find $\angle AOB$.




(A) 70°

(B) 110°

(C) 140°

(D) $90^\circ$

**Q10.** The diagonals of a rhombus are $24$ cm and $10$ cm. Find its area.

(A) $60$ cm$^2$

(B) $100$ cm$^2$

(C) $120$ cm$^2$

(D) $240$ cm$^2$

**Q11.** Find the curved surface area of a cylinder with radius $3.5$ cm and height $10$ cm. (Use $\pi = \frac{22}{7}$.)

(A) $110$ cm$^2$

(B) $154$ cm$^2$

(C) $176$ cm$^2$

(D) $220$ cm$^2$

**Q12.** Find the mode of the data set: $4,\ 7,\ 3,\ 9,\ 7,\ 4,\ 7,\ 2,\ 4,\ 7$.

(A) $7$

(B) $4$

(C) $9$

(D) $5$

**Q13.** Two fair dice are thrown simultaneously. What is the probability of getting a sum of $8$?

(A) $\frac{1}{6}$

(B) $\frac{5}{36}$

(C) $\frac{7}{36}$

(D) $\frac{1}{9}$

**Q14.** Find the distance between the points $A(1,\ 2)$ and $B(4,\ 6)$.

(A) $3$ units

(B) $4$ units

(C) $5$ units

(D) $7$ units

**Q15.** One zero of $p(x) = x^2 - 4x + k$ is three times the other zero. Find $k$.

(A) $1$

(B) $2$

(C) $4$

(D) $3$

# Detailed Solutions

## Q1.

**Solution**

**Concept — Number Systems (Rational vs Irrational):** A number is irrational if it cannot be expressed as $\frac{p}{q}$ with $p, q$ integers and $q \neq 0$.

**Step 1 — Evaluate each option.**

- $\sqrt{4} = 2$ (rational).
- $\sqrt{7}$ cannot be simplified to a fraction — it is **irrational**.
- $\sqrt{9} = 3$ (rational).
- $\sqrt{16} = 4$ (rational).

**Why other options are wrong:** Options A, C, and D are perfect squares, so their square roots are whole numbers (rational).

**Final Answer:** $\sqrt{7}$ is irrational $\Rightarrow \boxed{\text{B}}$

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

## Q2.

**Solution**

**Concept — Difference of Cubes Identity:**

$$a^3 - b^3 = (a-b)(a^2 + ab + b^2).$$

**Step 1 — Identify $a$ and $b$.** $x^3 - 8 = x^3 - 2^3$, so $a = x$ and $b = 2$.

**Step 2 — Apply the identity.**

$$x^3 - 2^3 = (x-2)(x^2 + 2x + 4).$$

**Step 3 — Verify.** $(x-2)(x^2+2x+4) = x^3 + 2x^2 + 4x - 2x^2 - 4x - 8 = x^3 - 8$ ✓.

**Why other options are wrong:**

- Option A: $(x+2)(x^2-2x+4)$ is the *sum* of cubes formula $a^3 + b^3$, not difference.
- Option B: $(x-2)(x^2-2x+4)$ has $-2x$ in the second factor instead of $+2x$.
- Option D: $(x+2)(x^2+2x+4)$ gives $x^3 + 8$, not $x^3 - 8$.

**Final Answer:** $x^3 - 8 = (x-2)(x^2+2x+4) \Rightarrow \boxed{\text{C}}$

$\boxed{\textbf{Answer: (C)}}$ Go Back to Q 2

## Q3.

### Solution

**Concept — Inverse Proportion (Work and Time):** More men $\Rightarrow$ fewer days. If $m_1$ men take $d_1$ days and $m_2$ men take $d_2$ days, then $m_1 d_1 = m_2 d_2$.

**Step 1 — Set up and solve.**

$$8 \times 12 = 6 \times d_2 \implies d_2 = \frac{96}{6} = 16 \text{ days.}$$

**Why other options are wrong:**

- Option A: $8$ days — confuses the number of men with days.
- Option B: $10$ days — $6 \times 10 = 60 \neq 96$.
- Option C: $14$ days — $6 \times 14 = 84 \neq 96$.

**Final Answer:** $6$ men take $16$ days $\Rightarrow \boxed{\text{D}}$

$\boxed{\textbf{Answer: (D)}}$ Go Back to Q 3

## Q4.

### Solution

**Concept — Successive Percentage Change:** After a $+x\%$ increase followed by a $-x\%$ decrease, the net change is $-\dfrac{x^2}{100}\%$ (always a decrease for $x \neq 0$).

**Step 1 — Trace with a starting value of $100$.**

$$100 \xrightarrow{+20\%} 120 \xrightarrow{-20\%} 120 \times 0.8 = 96.$$

**Step 2 — Net change.**

$$\text{Net change} = 96 - 100 = -4, \quad \text{i.e., a } 4\% \text{ decrease.}$$

**Quick formula check:** $-\dfrac{20^2}{100} = -\dfrac{400}{100} = -4\% \checkmark.$

**Why other options are wrong:**

- Option B: No change would result only if the percentage were applied to the original number each time, not successively.
- Option C: A $4\%$ increase is impossible since the decrease is applied to the higher value.
- Option D: A $2\%$ decrease would require $x = \sqrt{200} \approx 14.1\%$, not $20\%$.

**Final Answer:** Net change $= 4\%$ decrease $\Rightarrow \boxed{\text{A}}$

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

## Q5.

**Solution**

**Concept — Algebraic Identity:**

$$(a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab+bc+ca).$$

**Method 1 — Direct calculation.**

$$(1+2+3)^2 = 6^2 = 36.$$

**Method 2 — Verify via identity with $a = 1, b = 2, c = 3$.**

$$a^2 + b^2 + c^2 = 1 + 4 + 9 = 14; \quad 2(ab+bc+ca) = 2(2+6+3) = 22.$$

$$\text{Total} = 14 + 22 = 36. \quad \checkmark$$

**Why other options are wrong:**

- Option A: $14 = a^2 + b^2 + c^2$ (missing the cross terms $2(ab+bc+ca)$).
- Option C: $22 = 2(ab+bc+ca)$ (missing $a^2 + b^2 + c^2$).
- Option D: $24$ — an arithmetic error in combining the terms.

**Final Answer:** $(1+2+3)^2 = 36 \Rightarrow \boxed{\text{B}}$

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

## Q6.

**Solution**

**Concept — Vertically Opposite Angles:** When two lines intersect, the vertically opposite angles are equal.

$$\angle AOC = \angle BOD.$$

**Step 1 — Apply the theorem.**

$$\angle BOD = \angle AOC = 115^\circ.$$

**Step 2 — Verify adjacent angles.** $\angle AOB = 180^\circ - 115^\circ = 65^\circ$, so $\angle COD = 65^\circ$ (also a vertically opposite pair). Sum at $O$: $2(115^\circ) + 2(65^\circ) = 360^\circ$ ✓.

**Why other options are wrong:**

- Option A: $65^\circ = \angle AOB$ (the adjacent supplementary angle), not the vertically opposite one.
- Option B: $75^\circ$ has no basis at this intersection.
- Option D: $180^\circ$ is the angle on a straight line, not the vertically opposite angle.

**Final Answer:** $\angle BOD = 115^\circ \Rightarrow \boxed{\text{C}}$

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

## Q7.

**Solution**

**Concept — Exterior Angle Theorem:** An exterior angle of a triangle equals the sum of the two non-adjacent interior angles.

$$\angle PRS = \angle QPR + \angle PQR.$$

**Step 1 — Substitute the given angles.**

$$\angle PRS = 55^\circ + 60^\circ = 115^\circ.$$

**Step 2 — Verify.** Interior angle at $R$: $\angle PRQ = 180^\circ - 115^\circ = 65^\circ$. Angle sum: $55^\circ + 60^\circ + 65^\circ = 180^\circ$ ✓.

**Why other options are wrong:**

- Option A: $55^\circ = \angle QPR$ (one remote interior angle, not the exterior angle).
- Option B: $60^\circ = \angle PQR$ (the other remote interior angle).
- Option C: $65^\circ$ is the interior angle at $R$, supplementary to the exterior angle.

**Final Answer:** $\angle PRS = 115^\circ \Rightarrow \boxed{\text{D}}$

$\boxed{\textbf{Answer: (D)}}$ **Go Back to Q 7**

## Q8.

### Solution

**Concept — Rectangle (Diagonals):** The diagonals of a rectangle are equal in length and bisect each other.

$$PR = QS \quad \text{and} \quad OQ = \tfrac{1}{2}QS = \tfrac{1}{2}PR.$$

**Step 1 — Find $OQ$.**

$$OQ = \frac{PR}{2} = \frac{26}{2} = 13 \text{ cm}.$$

**Why other options are wrong:**

- Option B: 17 cm — has no geometric derivation from $PR = 26$ cm.
- Option C: 26 cm — equals the full diagonal $PR$, not half of it.
- Option D: $52 = 2 \times 26$ — doubles instead of halving.

**Final Answer:** $OQ = 13 \text{ cm} \Rightarrow \boxed{\text{A}}$

$\boxed{\textbf{Answer: (A)}}$ **Go Back to Q 8**

## Q9.

### Solution

**Concept — Tangent and Radius:** A tangent to a circle is perpendicular to the radius at the point of contact. In quadrilateral $OAPB$:

$$\angle OAP = \angle OBP = 90^\circ \implies \angle AOB + \angle APB = 180^\circ.$$

**Step 1 — Apply the relationship.**

$$\angle AOB = 180^\circ - \angle APB = 180^\circ - 70^\circ = 110^\circ.$$

**Step 2 — Verify.** Angle sum in $OAPB$: $90° + 70° + 90° + 110° = 360°$ ✓.

**Why other options are wrong:**

- Option A: $70° = \angle APB$ — the angle at $P$, not at $O$.
- Option C: $140° = 2 \times 70°$ — incorrectly doubles instead of applying the supplementary rule.
- Option D: $90°$ — the angle between the radius and the tangent at each contact point, not the angle $\angle AOB$.

**Final Answer:** $\angle AOB = 110° \Rightarrow \boxed{\text{B}}$

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

## Q10.

**Solution**

**Concept — Area of a Rhombus:**

$$\text{Area} = \frac{d_1 \times d_2}{2},$$

where $d_1$ and $d_2$ are the diagonals.

**Step 1 — Substitute the values.**

$$\text{Area} = \frac{24 \times 10}{2} = \frac{240}{2} = 120 \text{ cm}^2.$$

**Why other options are wrong:**

- Option A: $60 = (24 \times 10)/4$ — divides by $4$ instead of $2$.
- Option B: $100$ — no standard formula yields this result with $d_1 = 24$, $d_2 = 10$.
- Option D: $240 = 24 \times 10$ — forgets to divide by $2$.

**Final Answer:** Area $= 120 \text{ cm}^2 \Rightarrow \boxed{\text{C}}$

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

## Q11.

**Solution**

**Concept — Curved Surface Area of a Cylinder:**

$$\text{CSA} = 2\pi r h.$$

**Step 1 — Substitute $r = 3.5$ cm, $h = 10$ cm, $\pi = \frac{22}{7}$.**

$$\text{CSA} = 2 \times \frac{22}{7} \times 3.5 \times 10 = 2 \times \frac{22}{7} \times \frac{7}{2} \times 10 = 2 \times 11 \times 10 = 220\ \text{cm}^2.$$

**Why other options are wrong:**

- Option A: $110 = \pi r h$ (missing the factor of 2).
- Option B: $154 = \pi r^2 \times 4 =$ base area of a different solid; not CSA here.
- Option C: $176$ — an arithmetic slip in the computation above.

**Final Answer:** $\text{CSA} = 220\ \text{cm}^2 \Rightarrow \boxed{\text{D}}$

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

## Q12.

**Solution**

**Concept — Mode:** The mode is the value that appears most frequently in a data set.

**Step 1 — Count frequencies.**

| Value | 2 | 3 | 4 | 7 | 9 |
|---|---|---|---|---|---|
| Frequency | 1 | 1 | 3 | 4 | 1 |

**Step 2 — Identify the maximum frequency.** $7$ appears $4$ times, which is the highest frequency.

**Why other options are wrong:**

- Option B: $4$ appears only $3$ times, less than 7's $4$ times.
- Option C: $9$ appears only once.
- Option D: $5$ does not appear in the data at all.

**Final Answer:** $\text{Mode} = 7 \Rightarrow \boxed{\text{A}}$

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

## Q13.

**Solution**

**Concept — Probability with Two Dice:** Total sample space $= 6 \times 6 = 36$.

**Step 1 — List favourable outcomes (sum $= 8$).** $(2, 6)$, $(3, 5)$, $(4, 4)$, $(5, 3)$, $(6, 2)$ — a total of $5$ outcomes.

**Step 2 — Probability.**

$$P(\text{sum} = 8) = \frac{5}{36}.$$

**Why other options are wrong:**

- Option A: $\frac{1}{6} = \frac{6}{36}$ — six outcomes, not five, would be needed.
- Option C: $\frac{7}{36}$ corresponds to the sum $= 6$ (five pairs) or $= 10$ (three pairs); neither equals $8$'s five pairs.
- Option D: $\frac{1}{9} = \frac{4}{36}$ — only four favourable outcomes would be needed.

**Final Answer:** $P(\text{sum} = 8) = \dfrac{5}{36} \Rightarrow \boxed{\text{B}}$

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

## Q14.

**Solution**

**Concept — Distance Formula:**

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$

**Step 1 — Substitute $A(1, 2)$ and $B(4, 6)$.**

$$d = \sqrt{(4-1)^2 + (6-2)^2} = \sqrt{9 + 16} = \sqrt{25} = 5 \text{ units}.$$

**Why other options are wrong:**

- Option A: $3 = |4 - 1|$ — takes only the horizontal component, ignoring the vertical.
- Option B: $4 = |6 - 2|$ — takes only the vertical component, ignoring the horizontal.
- Option D: $7 = 3 + 4$ — adds components instead of using the Pythagorean theorem.

**Final Answer:** $AB = 5$ units $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 14

## Q15.

### Solution

**Concept — Vieta's Formulas:** For $p(x) = x^2 - 4x + k$, sum of zeroes $= 4$ and product of zeroes $= k$.

**Step 1 — Let the zeroes be $\alpha$ and $3\alpha$.**

**Step 2 — Use the sum of zeroes.**

$$\alpha + 3\alpha = 4 \implies 4\alpha = 4 \implies \alpha = 1.$$

**Step 3 — Use the product of zeroes to find $k$.**

$$k = \alpha \times 3\alpha = 3\alpha^2 = 3 \times 1^2 = 3.$$

**Step 4 — Verify.** $p(x) = x^2 - 4x + 3 = (x-1)(x-3)$. Zeroes: $1$ and $3$. Indeed $3 = 3 \times 1$ ✓.

**Why other options are wrong:**

- Option A: $k = 1$ gives $p(x) = x^2 - 4x + 1$, whose zeroes are $2 \pm \sqrt{3}$ — not in a $1 : 3$ ratio.
- Option B: $k = 2$ gives zeroes satisfying $\alpha(3\alpha) = 2$, so $\alpha = \sqrt{2/3}$, sum $\neq 4$.
- Option C: $k = 4$ gives $p(x) = (x-2)^2$, a repeated zero — not two distinct zeroes in ratio $1 : 3$.

**Final Answer:** $k = 3 \Rightarrow \boxed{\text{D}}$

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 |