TALLENTEX Mathematics

Sample Paper – 4

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**.
- Mobile phones, calculators, and electronic gadgets are **not allowed**.

Q1. Which of the following numbers is **irrational**?

(A) $\sqrt{4}$

(B) $\sqrt{9}$

(C) $\frac{3}{7}$

(D) $\sqrt{12}$

Q2. A two-digit number is such that the product of its digits is 18. When 27 is added to the number, the digits get reversed. Find the number.

(A) 36

(B) 29

(C) 63

(D) 92

Q3. 6 pipes can fill a tank in 12 hours. How many hours will 8 pipes take to fill the same tank, assuming all pipes work at the same rate?

(A) 16 hours

(B) 9 hours

(C) 8 hours

(D) 6 hours

Q4. An article costs Rs. 2500 before GST. If the GST rate is 18%, find the total price paid by the consumer.

(A) Rs. 2700

(B) Rs. 2800

(C) Rs. 2950

(D) Rs. 3000

Q5. Expand $(2a - 3b)^2$ using the identity $(x - y)^2 = x^2 - 2xy + y^2$.

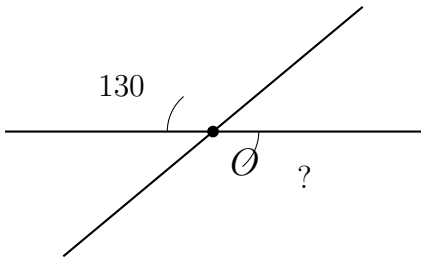
(A) $4a^2 + 12ab + 9b^2$

(B) $4a^2 - 6ab + 9b^2$

(C) $2a^2 - 12ab + 3b^2$

(D) $4a^2 - 12ab + 9b^2$

Q6. In the figure below, two straight lines intersect at point O. One of the angles formed is 130. Find the measure of the vertically opposite angle.



(A) 130

(B) 50

(C) 90

(D) 180

Q7. Which of the following sets of lengths can form the sides of a triangle?

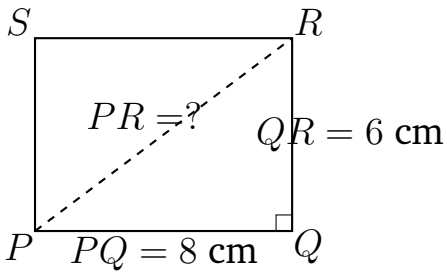
(A) 3 cm, 4 cm, 8 cm

(B) 5 cm, 7 cm, 4 cm

(C) 2 cm, 3 cm, 6 cm

(D) 1 cm, 1 cm, 3 cm

Q8. In rectangle $PQRS$, $PQ = 8$ cm and $QR = 6$ cm. Find the length of diagonal PR.



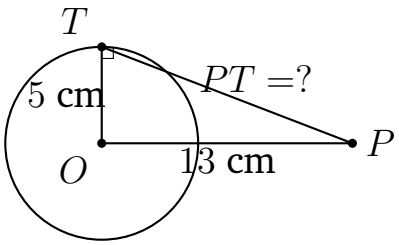
(A) $\sqrt{28}$ cm

(B) $\sqrt{48}$ cm

(C) 10 cm

(D) 14 cm

Q9. In the figure, O is the centre of a circle with radius $OT = 5$ cm. P is an external point at a distance $OP = 13$ cm from the centre. PT is a tangent to the circle at T. Find the length of PT.



(A) $\sqrt{194}$ cm

(B) 8 cm

(C) 11 cm

(D) 12 cm

Q10. Find the area of a triangle whose sides are 7 cm, 24 cm and 25 cm.

(A) 84 cm^2

(B) 96 cm^2

(C) 120 cm^2

(D) 168 cm^2

Q11. Find the volume of a cuboid with length 10 cm, breadth 8 cm and height 5 cm.

(A) 400 cm^3

(B) 400 cm^3

(C) 300 cm^3

(D) 450 cm^3

Q12. The mean of a data set is 15. If each observation in the data set is multiplied by 3, what is the new mean?

(A) 15

(B) 18

(C) 45

(D) 5

Q13. A card is drawn at random from a well-shuffled standard deck of 52 cards. What is the probability that the card drawn is a king?

(A) $\frac{1}{52}$

(B) $\frac{1}{26}$

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

(D) $\frac{1}{13}$

Q14. Using the distance formula, find the distance of the point $(3,\ 4)$ from the origin.

(A) 5 units

(B) 7 units

(C) $\sqrt{7}$ units

(D) 25 units

Q15. If $(x-1)$ is a factor of the polynomial $p(x) = x^3 + ax^2 - 4x + 3$, find the value of a.

(A) $a = 1$

(B) $a = 0$

(C) $a = -1$

(D) $a = 3$

Detailed Solutions

Q1.

Solution

Concept — Number Systems: A number is irrational if it cannot be expressed in the form $\frac{p}{q}$ where p and q are integers and $q \neq 0$. Square roots of non-perfect squares are irrational.

Step 1 — Check each option:

- $\sqrt{4} = 2$ (rational, perfect square)
- $\sqrt{9} = 3$ (rational, perfect square)
- $\frac{3}{7}$ (rational, a fraction of integers)
- $\sqrt{12} = 2\sqrt{3}$ (irrational, since $\sqrt{3}$ is irrational)

Why other options are wrong:

- Option A: $\sqrt{4} = 2$, which is a rational integer.
- Option B: $\sqrt{9} = 3$, which is a rational integer.
- Option C: $\frac{3}{7}$ is already in $\frac{p}{q}$ form, so it is rational.

Final Answer: $\sqrt{12}$ is irrational $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 1

Q2.

Solution

Concept — Playing with Numbers: Let the two-digit number have tens digit x and units digit y. Then the number $= 10x + y$.

Step 1 — Set up equations:
Product of digits: $x \times y = 18$
Adding 27 reverses the digits: $(10x + y) + 27 = 10y + x$

Step 2 — Solve:
From the second equation: $9x - 9y = -27 \Rightarrow x - y = -3 \Rightarrow y = x + 3$
Substituting into $xy = 18$: $x(x + 3) = 18 \Rightarrow x^2 + 3x - 18 = 0$
$(x + 6)(x - 3) = 0 \Rightarrow x = 3$ (taking positive value), $y = 6$
The number $= 10(3) + 6 = 36$.

Verification: $3 \times 6 = 18$ ✓; $36 + 27 = 63$ (digits reversed) ✓

Why other options are wrong:

- Option B: For 29, $2 \times 9 = 18$ but $29 + 27 = 56 \neq 92$.
- Option C: 63 is the reversed number, not the original.
- Option D: For 92, $9 \times 2 = 18$ but $92 + 27 = 119$, not a two-digit reversal.

Final Answer: The number is 36 $\Rightarrow$ A

Answer: (A) Go Back to Q 2

Q3.

Solution

Concept — Inverse Proportion: More pipes $\Rightarrow$ less time. Pipes and time are inversely proportional.

Step 1 — Apply inverse proportion formula:

$\text{Pipes}_1 \times \text{Time}_1 = \text{Pipes}_2 \times \text{Time}_2$

$6 \times 12 = 8 \times h$

$72 = 8h$

$h = 9$ hours

Why other options are wrong:

- Option A: 16 hours would mean fewer pipes, contradicting the setup.
- Option C: 8 hours uses direct proportion logic (wrong here).
- Option D: 6 hours is too small; adding more pipes saves only 3 hours.

Final Answer: 8 pipes take 9 hours $\Rightarrow$ B

Answer: (B) Go Back to Q 3

Q4.

Solution

Concept — Comparing Quantities (GST): Total price = Original price + GST amount.

Step 1 — Calculate GST:

$$\text{GST} = 18\% \text{ of Rs. } 2500 = \frac{18}{100} \times 2500 = \text{Rs. } 450$$

Step 2 — Total price:

$\text{Total} = \text{Rs. } 2500 + \text{Rs. } 450 = \text{Rs. } 2950$

Why other options are wrong:

- Option A: Rs. 2700 corresponds to 8% GST, not 18%.
- Option B: Rs. 2800 corresponds to 12% GST, not 18%.
- Option D: Rs. 3000 corresponds to 20% GST, not 18%.

Final Answer: Total price = Rs. 2950 $\Rightarrow$ C

Answer: (C) Go Back to Q 4

Q5.

Solution

Concept — Algebraic Identities: $(x-y)^2 = x^2 - 2xy + y^2$

Step 1 — Identify x and y:
Here $x = 2a$ and $y = 3b$.

Step 2 — Expand:
$(2a - 3b)^2 = (2a)^2 - 2(2a)(3b) + (3b)^2$
$= 4a^2 - 12ab + 9b^2$

Why other options are wrong:

- Option A: Uses $+$ sign in middle term; this would be $(2a + 3b)^2$.
- Option B: Middle term $-6ab$ is wrong; it should be $-12ab$.
- Option C: Coefficients $2a^2$ and $3b^2$ are wrong; squaring gives $4a^2$ and $9b^2$.

Final Answer: $(2a - 3b)^2 = 4a^2 - 12ab + 9b^2 \Rightarrow$ D

Answer: (D) Go Back to Q 5

Q6.

Solution

Concept — Lines and Angles: Vertically opposite angles are equal. When two straight lines intersect, the angles that are across from each other (vertically opposite) are always equal.

Step 1 — Apply the theorem:
The given angle $= 130$.
The vertically opposite angle $= 130$ (vertically opposite angles are equal).

Why other options are wrong:

- Option B: 50 is the supplement of 130, i.e., the adjacent angle, not the vertically opposite angle.
- Option C: 90 would only be the case if the lines were perpendicular.
- Option D: 180 is a straight angle (the two angles on a straight line add up to 180).

Final Answer: Vertically opposite angle $= 130 \Rightarrow \boxed{A}$

Answer: (A) Go Back to Q 6

Q7.

Solution

Concept — Triangle Inequality: For three lengths to form a triangle, the sum of any two sides must be greater than the third side.

Step 1 — Check each option:

- Option A: $3 + 4 = 7 < 8$ — does NOT form a triangle.
- Option B: $5 + 4 = 9 > 7$; $5 + 7 = 12 > 4$; $4 + 7 = 11 > 5$ — forms a triangle! ✓
- Option C: $2 + 3 = 5 < 6$ — does NOT form a triangle.
- Option D: $1 + 1 = 2 < 3$ — does NOT form a triangle.

Why other options are wrong:

- Option A: Sum of two smaller sides equals or is less than the largest side.
- Option C: $2 + 3 = 5$ is less than 6, violating the triangle inequality.
- Option D: $1 + 1 = 2$ is less than 3, violating the triangle inequality.

Final Answer: 5 cm, 7 cm, 4 cm can form a triangle $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q 7

Q8.

Solution

Concept — Quadrilaterals (Rectangle): In a rectangle, all angles are 90. The diagonal of a rectangle can be found using the Pythagorean theorem.

Step 1 — Apply Pythagoras theorem in $\triangle PQR$:
$\angle PQR = 90$ (angle of a rectangle)

$PR^2 = PQ^2 + QR^2 = 8^2 + 6^2 = 64 + 36 = 100$
$PR = \sqrt{100} = 10$ cm

Why other options are wrong:

- Option A: $\sqrt{28}$ would come from $2^2 + (\sqrt{24})^2$, not the given values.
- Option B: $\sqrt{48}$ comes from adding $6^2 + (\sqrt{12})^2$, not the correct values.
- Option D: 14 is simply the sum $8 + 6$, which is not how diagonals are calculated.

Final Answer: Diagonal $PR = 10$ cm $\Rightarrow$ C

Answer: (C) Go Back to Q 8

Q9.

Solution

Concept — Circles (Tangent-Radius): A tangent to a circle is perpendicular to the radius at the point of tangency. Therefore $OT \perp PT$, forming a right angle at T.

Step 1 — Apply Pythagoras theorem in $\triangle OTP$:
$\angle OTP = 90$ (tangent $\perp$ radius)
$OP^2 = OT^2 + PT^2$
$13^2 = 5^2 + PT^2$
$169 = 25 + PT^2$
$PT^2 = 144$
$PT = 12$ cm

Why other options are wrong:

- Option A: $\sqrt{194}$ would come from $13^2 + 5^2$, which adds instead of subtracts.
- Option B: 8 comes from $13 - 5$, which is arithmetic subtraction (not Pythagoras).
- Option C: 11 is incorrect; $11^2 = 121 \neq 144$.

Final Answer: $PT = 12$ cm $\Rightarrow$ D

Answer: (D) Go Back to Q 9

Q10.

Solution

Concept — Heron's Formula / Right Triangle: First verify if the triangle is a right triangle using the converse of Pythagoras' theorem.

Step 1 — Check if it is a right triangle:
$7^2 + 24^2 = 49 + 576 = 625 = 25^2$ ✓
So it is a right triangle with legs 7 cm and 24 cm, and hypotenuse 25 cm.

Step 2 — Find area:
$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 7 \times 24 = \frac{168}{2} = 84 \text{ cm}^2$

Why other options are wrong:

- Option B: 96 is $\frac{1}{2} \times 8 \times 24$, using wrong base.
- Option C: 120 is $\frac{1}{2} \times 10 \times 24$, using wrong values.
- Option D: 168 is 7×24, forgetting the $\frac{1}{2}$ factor.

Final Answer: Area $= 84 \text{ cm}^2 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 10

Q11.

Solution

Concept — Surface Areas and Volumes: Volume of a cuboid $= l \times b \times h$.

Step 1 — Substitute values:
$l = 10$ cm, $b = 8$ cm, $h = 5$ cm
$\text{Volume} = 10 \times 8 \times 5 = 400 \text{ cm}^3$

Why other options are wrong:

- Option C: 300 cm^3 could result from $10 \times 6 \times 5$ (wrong breadth).
- Option D: 450 cm^3 could result from $10 \times 9 \times 5$ (wrong breadth).

Final Answer: Volume $= 400 \text{ cm}^3 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 11

Q12.

Solution

Concept — Statistics (Effect on Mean): If every observation of a data set is multiplied by a constant k, the new mean = old mean $\times k$.

Step 1 — Apply the rule:
Old mean $= 15$, each observation multiplied by $k = 3$
New mean $= 15 \times 3 = 45$

Why other options are wrong:

- Option A: 15 would be the answer only if the constant were added, not multiplied.
- Option B: 18 would result from adding 3 to each observation, not multiplying.
- Option D: 5 would result from dividing each observation by 3.

Final Answer: New mean $= 45 \Rightarrow$ C

Answer: (C) Go Back to Q 12

Q13.

Solution

Concept — Probability: $P(\text{event}) = \dfrac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$

Step 1 — Count favourable outcomes:
A standard deck has 52 cards. There are 4 kings (one each of Hearts, Diamonds, Clubs, Spades).

Step 2 — Calculate probability:
$P(\text{King}) = \dfrac{4}{52} = \dfrac{1}{13}$

Why other options are wrong:

- Option A: $\frac{1}{52}$ is the probability of drawing one specific card (e.g., King of Hearts only).
- Option B: $\frac{1}{26}$ equals $\frac{2}{52}$, which would be for 2 kings, not 4.
- Option C: $\frac{2}{13}$ equals $\frac{8}{52}$, which would be for 8 cards.

Final Answer: $P(\text{King}) = \dfrac{1}{13} \Rightarrow$ D

Answer: (D) Go Back to Q 13

Q14.

Solution

Concept — Coordinate Geometry (Distance Formula): Distance from origin to point $(x, y) = \sqrt{x^2 + y^2}$

Step 1 — Apply the formula:
Distance $= \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$ units

Why other options are wrong:

- Option B: 7 is the sum $3 + 4$, not the Euclidean distance.
- Option C: $\sqrt{7}$ would come from $\sqrt{3 + 4}$, adding instead of squaring.
- Option D: 25 is 5^2, i.e., the distance squared, not the distance itself.

Final Answer: Distance $= 5$ units $\Rightarrow$ A

Answer: (A) Go Back to Q 14

Q15.

Solution

Concept — Polynomials (Factor Theorem): If $(x - c)$ is a factor of $p(x)$, then $p(c) = 0$.

Step 1 — Apply the Factor Theorem with $x = 1$:
$p(1) = 0$
$1^3 + a(1)^2 - 4(1) + 3 = 0$
$1 + a - 4 + 3 = 0$
$a + 0 = 0$
$a = 0$

Verification: With $a = 0$: $p(x) = x^3 - 4x + 3$.
$p(1) = 1 - 4 + 3 = 0$ ✓

Why other options are wrong:

- Option A: If $a = 1$, then $p(1) = 1 + 1 - 4 + 3 = 1 \neq 0$.
- Option C: If $a = -1$, then $p(1) = 1 - 1 - 4 + 3 = -1 \neq 0$.
- Option D: If $a = 3$, then $p(1) = 1 + 3 - 4 + 3 = 3 \neq 0$.

Final Answer: $a = 0 \Rightarrow$ B

Answer: (B) Go Back to Q 15

Answer Key

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