



TeenEagle

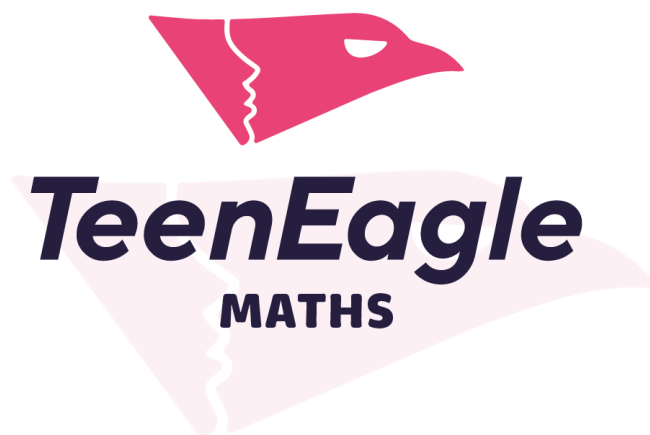
MATHS

PRACTICE QUESTIONS

TMC

Category - 6
Grade 11 - 12

Sample Questions



Topics this category covers:

Topics		
1	Logical Thinking	Construction problems Speed-distance-time problems Advanced number and figure problems Logical age and date problems
2	Pure Mathematics	Functions Coordinate Geometry Trigonometry Series Differentiation Integration Logarithmic and exponential functions
3	Probability and Statistics	Coding Permutations and combinations
4	Mechanics	Forces and Equilibrium Calculus in Kinematics Momentum (Multiple collisions)

1. (Logical Thinking)

3 points

Each letter is assigned a unique figure on the equivalence side. According to the observed pattern, which option should correctly replace the question mark?

HABABAM = ?

(A) X + X + - + :

(B) : + - + X + -

(C) - + X + X + :

(D) : X + X - X +

2. (Logical Thinking)

3 points

Each number is assigned a unique figure on the equivalence side. According to the observed pattern, which option should correctly replace the question marks?

I. $\left. \begin{array}{l} 357 \\ 735 \\ 537 \\ 753 \\ 375 \end{array} \right\}$ II. $\left\{ \begin{array}{l} \star \otimes \blacktriangle \\ \otimes \star \blacktriangle \\ \blacktriangle \otimes \star \\ \star \blacktriangle \otimes \\ \otimes \blacktriangle \star \end{array} \right\} \Rightarrow 753 = ?$

(A) $\star \otimes \blacktriangle$

(B) $\otimes \star \blacktriangle$

(C) $\star \blacktriangle \otimes$

(D) $\otimes \blacktriangle \star$

3. (Logical Thinking)

3 points

According to the observed pattern, which option should correctly replace the question mark?

1	2	3	4	5	6	7	8	9
7	5	1	9	6	2	8	4	3
?								
1	2	3	4	5	6	7	8	9

(A) 369825147

(B) 369821574

(C) 369285174

(D) 369825174

4. (Logical Thinking)

3 points

According to the observed pattern, which option should correctly replace the question marks?

a 7 b 3 t 1 Δ $\star$ 2 c $\square$

b 2 7 a $\rightarrow$ 3 c b 7

t $\square$ $\star$ 1 $\rightarrow$ 1 a 2 Δ

a Δ 3 c $\rightarrow$?

(A) 7 $\star$ t $\square$

(B) 7 $\star$ 1 $\square$

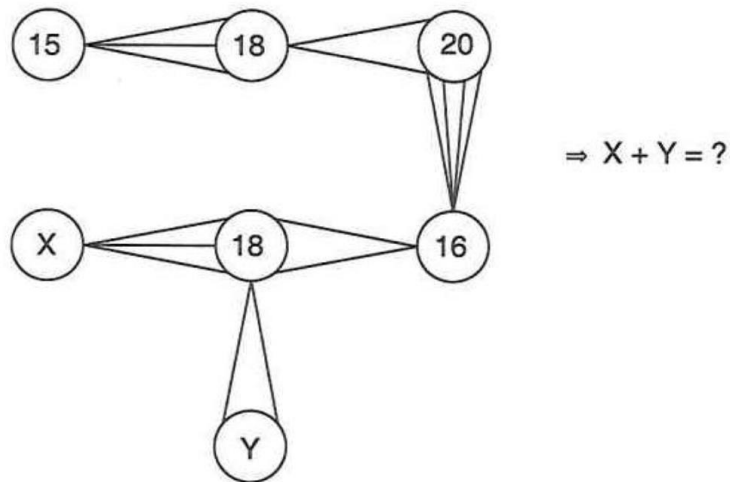
(C) $\square$ 1 b 2

(D) $\square$ 1 c 2

5. (Logical Thinking)

3 points

According to the observed pattern, which option should correctly replace the question mark?



- (A) 32 (B) 33 (C) 34 (D) 35

6. (Logical Thinking)

3 points

According to the observed pattern, what is the answer of the third option?

I. $\equiv 4(6a + 5b + 2c + 3d)$

II. $\equiv 132$

III. $\equiv ?$

- (A) 282 (B) 288 (C) 276 (D) 294

7. (Logical Thinking)

3 points

In the table each row follows the same rule. Which number replaces the question mark?

Row 1: 2, 3, 7

Row 2: 3, 5, 16

Row 3: 4, ?, 25

- (A) 5 (B) 6 (C) 7 (D) 8

8. (Logical Thinking)

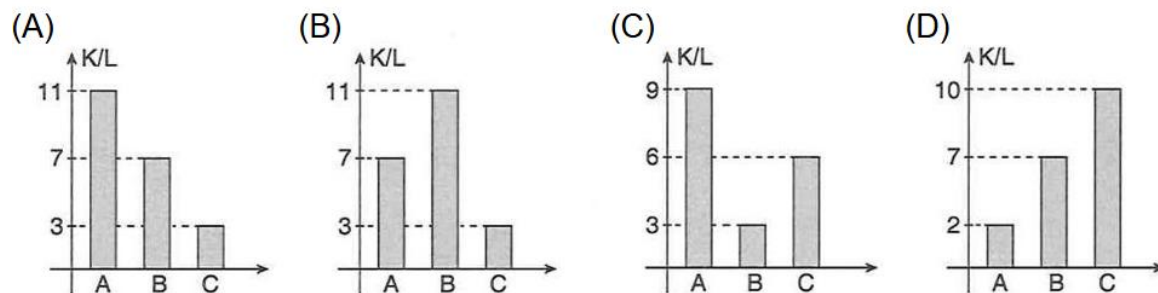
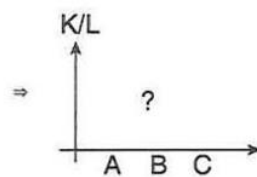
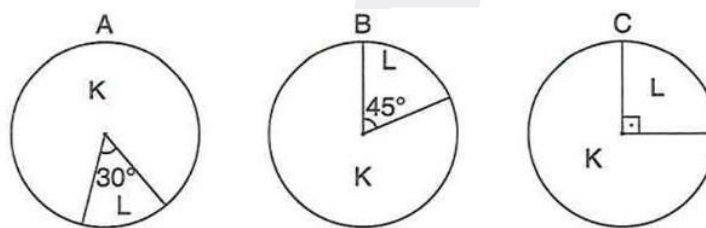
3 points

Which 4-digit number, when multiplied by 4, equals the integer formed by reversing its digits?

- (A) 1089 (B) 2178 (C) 8712 (D) 21978

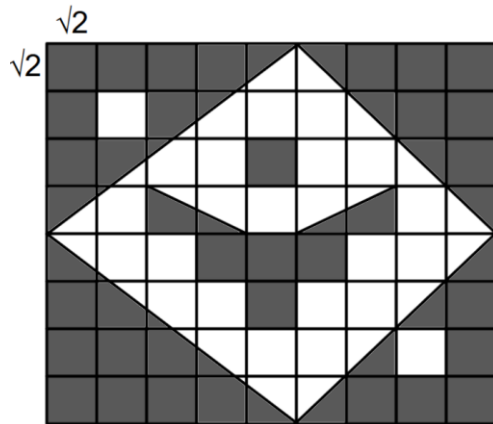
9. (Logical Thinking)

3 points



10. (Logical Thinking)

3 points



In the figure shown, each cube has a side length of $\sqrt{2}$ cm. What is the total area of the shaded region?

- (A) 82 cm^2 (B) 62 cm^2 (C) 144 cm^2 (D) 86 cm^2

11. (1 - Functions)

4 points

The functions $f(x)$ and $g(x)$ are defined as follows:

$$f(x) = 1 + \frac{2x}{x-2}, x > 2$$

$$g(x) = x^2 - 2, x \in \mathbb{R}$$

where a and b are constants.

Given that $f(7) = \frac{5}{2}$, find the expression for $g(5)$ in terms of b .

- (A) $\frac{7}{2}b - 2$ (B) $\frac{3}{7}b - 2$ (C) $7b - 2$ (D) $3b - 7$

12. (1 - Functions)

4 points

The curve with equation $y = x^2 + 2x - 5$ is translated by $\begin{pmatrix} -1 \\ 3 \end{pmatrix}$.
Find the vertex of the curve after translation.

- (A) (-2, -3) (B) (2, -3) (C) (2, 3) (D) (-2, 3)

13. (1 - Pure Mathematics: Coordinate Geometry)

4 points

Points A and B have coordinates (8, 3) and (p, q) respectively. The equation of the perpendicular bisector of AB is $y = -2x + 4$. Find the values of p and q, respectively.

- (A) (4, -3) (B) (4, 3) (C) (-4, -3) (D) (-4, 3)

14. (1 - Pure Mathematics: Trigonometry)

4 points

A curve has equation $y = 2 + 3 \sin\left(\frac{1}{2}x\right)$, for $0 \leq x \leq 4\pi$. State the greatest and least value of y, respectively.

- (A) 5, -1 (B) 5, 1 (C) -5, 1 (D) -5, -1

15. (1 - Pure Mathematics: Trigonometry)

4 points

Solve the question:

$$8 \sin^2 \theta + 6 \cos \theta + 1 = 0, \quad \text{for } 0^\circ < \theta < 180^\circ$$

- (A) 138.6 (B) 0 (C) 48.6 (D) 221.4

16. (1 - Pure Mathematics: Series)

4 points

The first, second and third terms of a geometric progression are $2p + 6$, $5p$ and $8p + 2$ respectively. Find the positive value of the constant p .

- (A) 4 (B) 5 (C) 6 (D) 7

17. (1 - Pure Mathematics: Series)

4 points

In an arithmetic progression the first term is a and the common difference is 3. The n th term is 94 and the sum of the first n terms is 1420. Find $n + a$.

- (A) 15 (B) 17 (C) 12 (D) 7

18. (1 - Pure Mathematics: Differentiation)

4 points

The function f is such that

$$f(x) = x^3 - 3x^2 - 9x + 2 \text{ for } x > 2,$$

where x is an integer. It is given that f is an increasing function. Find the least possible value of x .

- (A) 3 (B) -2 (C) 2 (D) 5

19. (1 - Pure Mathematics: Logarithmic and exponential functions)

4 points

Solve the inequality $2^{a-1} \leq 5(3^{2a-1})$. Giving your answer in the form $\frac{a}{b}$ where a and b are real numbers.

- (A) $a \geq \frac{\log(\frac{2}{9})}{\log(\frac{10}{3})}$ (B) $a \geq \frac{\log(\frac{10}{3})}{\log(\frac{2}{9})}$ (C) $a \leq \log(\frac{10}{9})$ (D) $a \leq \log(\frac{10}{9})$

20. (1 - Pure Mathematics: Momentum)

4 points

Particles P of mass m kg and Q of mass 0.2 kg are free to move on a smooth horizontal plane. P is projected at a speed of 2 m/s towards Q which is stationary. After the collision P and Q move in opposite directions with speeds of 0.5 m/s and 1 m/s respectively. Find m .

- (A) 0.2 (B) 0.08 (C) 0.1 (D) 0.04

21. (1 - Functions)

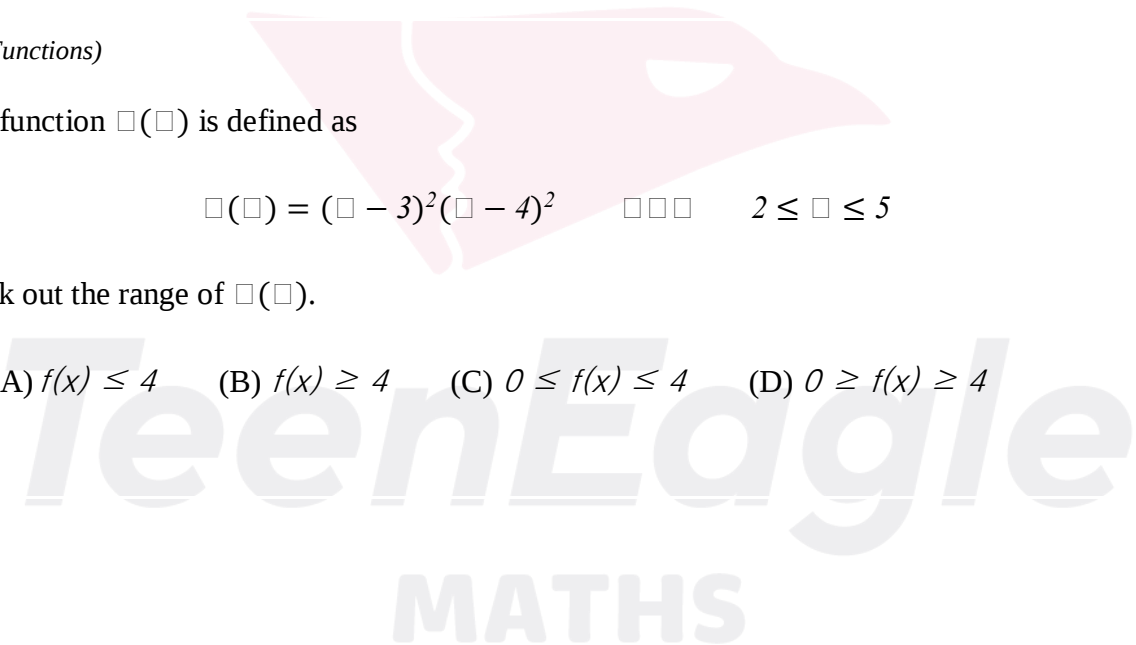
5 points

The function $f(x)$ is defined as

$$f(x) = (x - 3)^2(x - 4)^2 \quad \text{for } 2 \leq x \leq 5$$

Work out the range of $f(x)$.

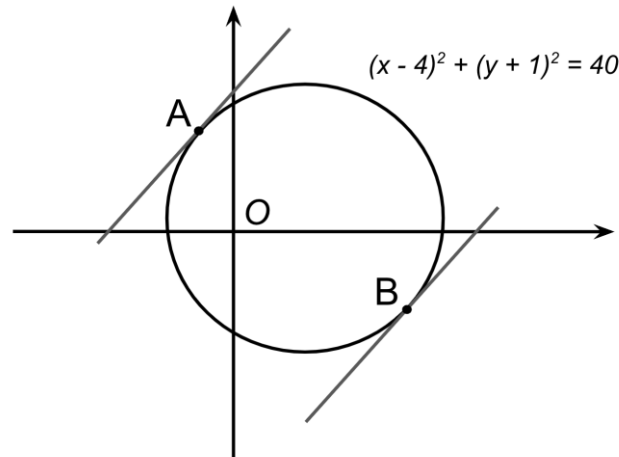
- (A) $f(x) \leq 4$ (B) $f(x) \geq 4$ (C) $0 \leq f(x) \leq 4$ (D) $0 \geq f(x) \geq 4$



22. (1 - Pure Mathematics: Coordinate Geometry)

5 points

The diagram shows the circle with equation $(x - 4)^2 + (y + 1)^2 = 40$.



Parallel tangents each with gradient 1, touches this circle at points A and B. Find the equation of a line AB giving the answer in the form $y = mx + c$

- (A) $y = x - 3$
- (B) $y = -x - 3$
- (C) $y = x + 3$
- (D) $y = -x + 3$

23. (1 - Pure Mathematics: Trigonometry)

5 points

Find the exact solution of the equation:

$$\frac{1}{6} \sin \theta + \cos \theta \cos^{-1}(\frac{\sqrt{3}}{2}) = -\cos \theta \cos^{-1}(\frac{\sqrt{3}}{2})$$

- (A) $\frac{\sqrt{3}}{4}$
- (B) $-\frac{\sqrt{3}}{4}$
- (C) $\frac{1}{4}$
- (D) $\frac{\sqrt{3}}{2}$

24. (1 - Pure Mathematics: Series)

5 points

An arithmetic progression has first term -12 and common difference 6. The sum of the first n terms exceeds 3000. Calculate the least possible value of n .

- (A) 37
- (B) 36
- (C) 34
- (D) 35

25. (1 - Pure Mathematics: Differentiation)

5 points

The line $3x + y = 25$ is a normal to the curve $y = x^2 - 5x + k$. Find the value of the constant k .

- (A) $1/11$ (B) $-1/11$ (C) 11 (D) -11

26. (2 - Probability and Statistics: Coding)

5 points

Wildlife researchers are studying the swimming speeds, x m/h, of two species of penguin: the emperor penguin and the gentoo penguin. The mean swimming speed of 40 gentoo penguins was found to be 31.4 m/h and the standard deviation was found to be 3.8 m/h.

Allowing x to represent the swimming speeds of the gentoo penguins, calculate the value of $\sum x^2$.

- (A) 1000.4 (B) 1833.6 (C) 39590.4 (D) 40016

27. (2 - Probability and Statistics: Permutations and combinations)

5 points

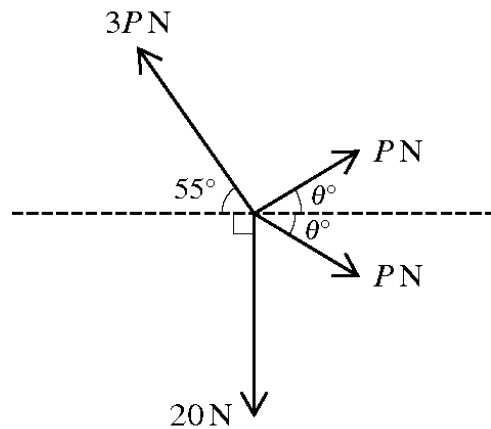
A mixed relay team of 4 must consist of 2 men and 2 women. There are 9 men and 6 women to choose from, including a brother and sister who will only be on the team if they are both selected. How many ways can the team be chosen, ensuring the brother and sister are either both in or both out?

- (A) 320 (B) 280 (C) 360 (D) 40

28. (3 - Mechanics: Forces and Equilibrium)

5 points

The four coplanar forces shown in the diagram are in equilibrium.



Find the value of P , correct to two decimal places.

- (A) 11.14 (B) 8.14 (C) 12.14 (D) 9.14

29. (3 - Mechanics: Calculus in Kinematics)

5 points

A particle P moves in a straight line, starting from a point O . At time t s after leaving O , the velocity of P , $\frac{m}{s}$, is given by $v = 4t^2 - 8t + 3$.

Find the distance traveled by point P between the two times when it is at instantaneous rest.

- (A) $\frac{2}{3}$ m (B) $\frac{3}{2}$ m (C) $\frac{5}{2}$ m (D) $\frac{2}{5}$ m

30. (3 - Mechanics: Momentum (Multiple collisions))

5 points

Two blocks A and B , of masses $m_A = 2 \text{ kg}$ and $m_B = 3 \text{ kg}$, are moving towards each other with velocities $u_A = 5 \text{ m/s}$ and $u_B = 4 \text{ m/s}$, respectively. They collide head-on and rebound elastically. After the collision, block B collides elastically with another block C of mass $m_C = 5 \text{ kg}$, which is initially at rest.

Calculate the total kinetic energy after collisions.

- (A) 45 J (B) 49 J (C) 51 J (D) 55 J



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MATHS

Answer key (Exam Questions)

1. C
2. C
3. D
4. A
5. D
6. C
7. B
8. B
9. A
10. A
11. A
12. A
13. C
14. A
15. A
16. C
17. B
18. A
19. B
20. B
21. C
22. D
23. B
24. D
25. C
26. D
27. A
28. B
29. A
30. B



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