Answer **all** *the questions.*

Each *question is followed by* **four** *options lettered* A *to* D. *Find the correct option for* **each** *question and shade* **in pencil**, *on your answer sheet, the answer space which bears the same letter as the option you have chosen. Give only* **one** *answer to* **each** *question. An example is given below.*

The ages, in years, of four boys are 10, 12, 14 and 16. What is the mean age of the boys?

A. 12 years
B. $12\frac{1}{2}$ years
C. 13 years
D. $13\frac{1}{2}$ years

The correct answer is 13 years, *which is lettered* C, *and therefore answer space* C *would be shaded.*

[A] [B] [C] [D]

Think carefully before you shade the answer spaces; erase completely any answer(s) you wish to change.

Do **all** *rough work on this question paper.*

Now answer the following questions.

1. Given that $2^{(x^2 + 2x)} = 8$, find the values of x.

A. 3, 1
B. 3, − 1
C. − 3, 1
D. − 3, − 1

2. A binary operation * is defined on the set of real numbers, R, by $x * y = x - y + 2xy$.
If $x * (-5) = -13$, find the value of x.

A. $\frac{9}{2}$
B. 2
C. − 2
D. $-\frac{9}{2}$

3. Find the equation of the line through the point P (− 1, 2) which is perpendicular to $3x - 7y + 2 = 0$.

A. $7x + 3y - 13 = 0$
B. $7x + 3y + 1 = 0$
C. $3x + 7y + 13 = 0$
D. $3x + 7y + 1 = 0$

4. Find the **fourth** term in the binomial expansion of $(x - y)^4$.

A. $4x^2y^2$
B. $4xy^3$
C. $-4x^2y^2$
D. $-4xy^3$

21. Given that $M = \begin{pmatrix} 0.2 & 0.9 \\ -0.1 & 1.1 \end{pmatrix}$ and $N = \begin{pmatrix} 0.9 & -1.6 \\ 0.3 & 4.1 \end{pmatrix}$, evaluate, correct to two decimal places, $|M - 2N|$.

A. 14.23
B. 11.36
C. − 2.87
D. − 11.36

22. Given that $\overrightarrow{PQ} = 5i + 3j$ and $\overrightarrow{PR} = 2i + 5j$, find $\overrightarrow{RQ}$.

A. $7i + 8j$
B. $3i - 2j$
C. $-3i + 2j$
D. $3i + 8j$

23. Find the **least** value of x that satisfies $x + \sqrt{3x+4} = 8$.

A. 3
B. 4
C. 5
D. 7

24. How many terms of the Linear Sequence (*A.P.*) 6, 2, −2, . . . must be added to obtain a sum of −714?

A. 17
B. 19
C. 21
D. 23

25. If $(x + 5)$ and $(x - 3)$ are factors of $kx^2 + 6x + q$, find the value of $q - 3k$.

A. 54
B. 36
C. − 48
D. − 54

26. Express cos 135° as a simple surd(radicals).

A. $-\frac{\sqrt{2}}{2}$
B. $-\frac{1}{2}$
C. $\frac{1}{2}$
D. $\frac{\sqrt{2}}{2}$

27. Find the values of m for which $(m + 5)x^2 + (m^2 - 1)y^2 + 2x - 5y + 5 = 0$ is an equation of a circle.

A. $m = -2$ and 3
B. $m = -2$ and -3
C. $m = 2$ and -3
D. $m = 2$ and 3

28. In triangle XYZ, $|XY| = 8\ cm$, $|YZ| = 10\ cm$ and $\angle XYZ = 42°$. Calculate the length of XZ.

A. 6.72 *cm*
B. 11.52 *cm*
C. 11. 82 *cm*
D. 12.72 *cm*

29. Given that $F = \{(x+1)!, x \in N \text{ and } 0 < x \leq 5\}$, $G = \{(2x-1)!, x \in N \text{ and } 0 < x < 7\}$ and $H = \{(2x+1)!, x \in N \text{ and } 1 < x \leq 5\}$ are three sets, find $F \cap (G \cup H)$.

A. {3!, 5!}
B. {3!, 5!, 7!}
C. {5!, 7!}
D. {5!, 7!, 9!}

13. Simplify: $4 - \frac{1}{2-\sqrt{3}}$.

A. $7 - 4\sqrt{3}$

B. $2 - \sqrt{3}$

C. $2 + \sqrt{3}$

D. $7 + 4\sqrt{3}$

14. The probabilities that John, Rose and Tom will win a prize in a competition are $\frac{3}{5}$, $\frac{2}{3}$ and $\frac{5}{7}$ respectively. Calculate the probability that exactly **two** of them would win the prize.

A. 0.5714

B. 0.4476

C. 0.4286

D. 0.3429

15. A force P N acts on a body of mass 4 kg moving at 8 ms^{-1} for 0.5 *seconds*. If the final velocity is 10 ms^{-1}, find P.

A. 144

B. 100

C. 16

D. 12

16. Simplify: ${}^{(2n+3)}C_1 - {}^{(n+1)}C_1$.

A. $2n + 2$

B. $n + 4$

C. $n + 2$

D. $n + 1$

17. If $g : x \rightarrow \frac{7}{5-4x}$ where $x \neq \frac{5}{4}$, find $g^{-1}(x)$.

A. $g^{-1}(x) = \frac{5x-7}{4x}, x \neq 0$

B. $g^{-1}(x) = \frac{5x+7}{4x}, x \neq 0$

C. $g^{-1}(x) = \frac{5+7x}{4x}, x \neq 0$

D. $g^{-1}(x) = \frac{5-7x}{4x}, x \neq 0$

18. If $\frac{5x+P}{x^2-3x+2} \equiv \frac{11}{x-2} + \frac{Q}{x-1}$, where P and Q are constants, find the value of $(P + Q)$.

A. -7

B. -5

C. 5

D. 7

19. If $\int_{-1}^{2}(kx-2)\,dx = 0$, find the value of k.

A. -4

B. $-\frac{1}{2}$

C. $\frac{1}{2}$

D. 4

20. Given that a particle of mass 2.5 kg has an initial velocity of $(6\boldsymbol{i} - 4\boldsymbol{j})\ ms^{-1}$ and a final velocity of $(-8\boldsymbol{i} + 2\boldsymbol{j})\ ms^{-1}$, find the change in momentum in Ns.

A. $35\boldsymbol{i} - 15\boldsymbol{j}$

B. $-35\boldsymbol{i} + 15\boldsymbol{j}$

C. $-14\boldsymbol{i} + 6\boldsymbol{j}$

D. $-5\boldsymbol{i} - 5\boldsymbol{j}$

5. Find the range of values of x for which $x^2 - 3x + 2 < 0$.

A. $-2 < x < 1$

B. $-1 < x < 2$

C. $-2 < x < -1$

D. $1 < x < 2$

6. The probability of Elohor passing any examination is $\frac{1}{3}$. If she takes **three** examinations, calculate the probability that she will fail **two** of them.

A. $\frac{4}{9}$

B. $\frac{2}{9}$

C. $\frac{8}{27}$

D. $\frac{1}{27}$

7. Evaluate: $\lim_{x \to 2}\left(\frac{x-2}{x^2-4}\right)$.

A. 0

B. $\frac{1}{4}$

C. $\frac{1}{2}$

D. 1

8. The first term of a geometric series is 350. If the sum to infinity is 250, find the common ratio.

A. $-\frac{5}{7}$

B. $-\frac{2}{5}$

C. $\frac{2}{5}$

D. $\frac{5}{7}$

9. Simplify: $\frac{\log_2 \sqrt{8}}{\log_8\left(\frac{1}{8}\right)}$.

A. $\frac{3}{2}$

B. $\frac{3}{4}$

C. $-\frac{3}{4}$

D. $-\frac{3}{2}$

10. Find the area of the finite region enclosed by the curve $y = 3x^2 - 2x + 1$ and the lines $x = 1$ and $x = 2$.

A. 12 *square units*

B. 10 *square units*

C. 7 *square units*

D. 5 *square units*

11. A stone is thrown vertically upwards with a velocity of 10 ms^{-1} from a point 8 m above the ground. Find the maximum height reached.

[Take $g = 10\ ms^{-2}$]

A. 13 m

B. 15 m

C. 18 m

D. 23 m

12. If $3\begin{pmatrix} -5 & 2 \\ 1 & 7 \end{pmatrix} + \begin{pmatrix} x & 7 \\ 4 & y \end{pmatrix} = \begin{pmatrix} -7 & 13 \\ 7 & 26 \end{pmatrix}$, find the values of x and y.

A. $x = -8, y = -5$

B. $x = -7, y = -5$

C. $x = 7, y = 5$

D. $x = 8, y = 5$

The table shows the distribution of marks scored by students in a test.

Marks	0	1	2	3	4	5
Number of candidates	6	4	8	10	9	3

Use it to answer questions **30** *and* **31**.

30. Find the third quartile.

A. 3.0
B. 3.5
C. 4.0
D. 4.5

31. What percentage of the students scored more than the modal mark?

A. 10%
B. $22\frac{1}{2}$ %
C. 30%
D. 55%

32. If $p = (7\ km, 053°)$ and $q = (5\ km, 233°)$, find $(p + q)$.

A. $(12\ km, 053°)$
B. $(12\ km, 233°)$
C. $(2\ km, 233°)$
D. $(2\ km, 053°)$

33. The mapping $f: x \rightarrow x^2 + mx + n$ is defined on the set of real number, R. If $f(-1) = 2$ and $f(1) = -2$, find the values of m and n.

A. $m = 1, n = 2$
B. $m = -1, n = 2$
C. $m = -2, n = -1$
D. $m = -2, n = -2$

34. Find the acute angle between lines $x + y - 2 = 0$ and $3x - 2y - 1 = 0$.

A. 87.7°
B. 78.7°
C. 68.1°
D. 67.2°

35. A uniform rod, PQ of length 100 *cm* and mass 10 *g* is kept in a horizontal position on a pivot at the point 30 *cm* from P. If a 4 *g* mass is suspended at the point 10 *cm* from P, find the mass that must be suspended at 80 *cm* from Q in order to keep the system in equilibrium.
[Take $g = 10\ ms^{-2}$]

A. 12 *g*
B. 10 *g*
C. 8 *g*
D. 6 *g*

Consider the following statements:

P : Those who studied Physics are Engineers

Q : Engineers are wealthy

36. Which of the following is a **valid** conclusion?

A. Ben is wealthy implies he is an Engineer
B. Ben didn't study Physics implies he is not an Engineer
C. Ben studied Physics but he is not wealthy
D. Ben studied Physics and he is wealthy

37. A polynomial is defined by $2x^3 - 7x^2 + 3x + 5$. Find the remainder when it is divided by $(x - 3)$.

A. 13
B. 12
C. 11
D. 5

38. Simplify: $\frac{(n-1)!}{n(n!)}$.

A. $\frac{1}{n!}$

B. $\frac{1}{n^2}$

C. $\frac{1}{n}$

D. $\frac{1}{n+1}$

39. Find, in ascending powers of x, the **third** term in the binomial expansion of $(2-x)^5$.

A. $-80x^3$

B. $-80x^2$

C. $80x^2$

D. $80x^3$

40. The length of the sides of a metal cube increases at a rate of 0.1 m per second. Find the rate at which the volume increases at the instance when the length is 1.2 m.

A. $8.413\ m^3s^{-1}$

B. $4.320\ m^3s^{-1}$

C. $2.881\ m^3s^{-1}$

D. $0.432\ m^3s^{-1}$

END OF PAPER