

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 ]



[ 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. A binary operation  $*$  is defined on the set  $R$  of real numbers by  $p * q = (p + q)^2 + 2p$ , where  $p, q \in R$ . Find the value of  $(-3 * 7) + 5$ .

- A. 27
- B. 15
- C. -15
- D. -27

2. Solve:  $\left(3^{x^2}\right) = \frac{1}{81}\left(3^{5x}\right)$ .

- A. 1 or 4
- B. 1 or -4
- C. -1 or 4
- D. -1 or -4

3. If  $x = \frac{p\sqrt{q}}{r}$ , which of the following represents  $\log_{10} x$ ?

- A.  $\frac{\log_{10} p \times \log_{10} \sqrt{q}}{\log_{10} r}$
- B.  $\log_{10} p + \frac{1}{2} \log_{10} q + \log_{10} r$
- C.  $\frac{\log_{10} p + \frac{1}{2} \log_{10} q}{\log_{10} r}$
- D.  $\log_{10} p + \frac{1}{2} \log_{10} q - \log_{10} r$

4. If  $\int_4^9 \left(\frac{1}{\sqrt{x}}\right) dx = y$ , find the value of  $y$ .

- A.  $\frac{1}{6}$
- B.  $\frac{2}{3}$
- C. 2
- D. 3

5. Given that  $(3x-1)$ ,  $(x+1)$  and  $(x-1)$  are the first 3 consecutive terms of an exponential sequence (G.P), where  $x > 0$ . Find the value of  $x$ .
- A. 6  
B. 3  
C. 2  
D. 1
6. Find the equation of the axis of symmetry of  $y = -4x^2 + 9x - 13$ .
- A.  $x = \frac{9}{8}$   
B.  $x = \frac{8}{9}$   
C.  $x = -\frac{8}{9}$   
D.  $x = -\frac{9}{8}$
7. Given that  ${}^{(n+1)}P_2 = 12$ , find the value of  $n$ .
- A. 12  
B. 6  
C. 4  
D. 3
8. Given that  $f(x) = \frac{5x+8}{7-3x}$ ,  $x \neq \frac{7}{3}$ , find  $f^{-1}(2)$ .
- A.  $\frac{11}{6}$   
B.  $\frac{6}{11}$   
C.  $-\frac{6}{11}$   
D.  $-\frac{11}{6}$
9. Find the sum to infinity of  $5 + \frac{10}{3} + \frac{20}{9} + \dots$
- A.  $\frac{5}{3}$   
B. 3  
C. 5  
D. 15
10. For what values of  $x$  is  $11x + 12 > x^2$ ?
- A.  $-1 < x < 12$   
B.  $-1 < x < \frac{1}{12}$   
C.  $x \leq -1$  or  $x \geq \frac{1}{12}$   
D.  $x \leq -1$  or  $x \geq 12$
11. Which of the following is a factor of  $x^3 + 2x^2 - 3x$ ?
- A.  $(x+2)$   
B.  $(x+1)$   
C.  $(x-3)$   
D.  $(x+3)$
12. If the curve  $y = 3x^2 + 10x + 2$  passes through  $(x, -6)$ , find the least value of  $x$ .
- A. -5  
B. -4  
C. -3  
D. -2



13. If  $\cos(y) = -\frac{1}{3}$ , where  $90^\circ < y < 180^\circ$ , find  $\operatorname{cosec}(y)$ .

A.  $\frac{3}{4}\sqrt{2}$

B.  $\frac{4}{3}\sqrt{2}$

C.  $-\frac{3}{4}\sqrt{2}$

D.  $-\frac{4}{3}\sqrt{2}$

14. Find the equation of a circle with centre  $(6, -11)$  and radius 8 units.

A.  $x^2 + y^2 - 12x + 22y + 93 = 0$

B.  $x^2 + y^2 - 12x - 22y + 93 = 0$

C.  $x^2 + y^2 - 12x + 22y - 93 = 0$

D.  $x^2 + y^2 - 12x - 22y - 93 = 0$

15. If  $\begin{pmatrix} 4 & -2 \\ x & 6 \end{pmatrix} \begin{pmatrix} 2 \\ -5 \end{pmatrix} = 4 \begin{pmatrix} 4.5 \\ -11 \end{pmatrix}$ , find the value of  $x$ .

A.  $-9$

B.  $-7$

C.  $7$

D.  $9$

16. A committee of two is to be selected from 5 boys and 3 girls. What is the probability that it will consist of a boy and a girl?

A.  $\frac{15}{28}$

B.  $\frac{5}{28}$

C.  $\frac{3}{28}$

D.  $\frac{2}{7}$

17. Two bodies having masses of 6 kg and 4 kg moving in the same direction with velocities  $2 \text{ ms}^{-1}$  and  $4 \text{ ms}^{-1}$  respectively, collide with each other. If they stick together after collision, find their common velocity.

A.  $1.6 \text{ ms}^{-1}$

B.  $2.8 \text{ ms}^{-1}$

C.  $3.2 \text{ ms}^{-1}$

D.  $3.6 \text{ ms}^{-1}$

18. The table shows the distribution of marks obtained by students in a Mathematics test.

Marks	1-5	6-10	11-15	16-20
Number of Students	5	5	$x$	8
Cumulative Frequency	5	10	12	$y$

Find the value of  $(2x + y)$ .

A. 38

B. 34

C. 28

D. 24

19. A ball is thrown vertically upwards with a velocity of  $12 \text{ ms}^{-1}$ . Calculate the maximum height reached.

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

A. 10.0 m

B. 9.6 m

C. 7.2 m

D. 6.4 m

20. Simplify:  $\frac{m-n}{\sqrt{m}-\sqrt{n}}$

A.  $\frac{\sqrt{m}-\sqrt{n}}{m-n}$

B.  $\frac{\sqrt{m}+\sqrt{n}}{m-n}$

C.  $\sqrt{m}-\sqrt{n}$

D.  $\sqrt{m}+\sqrt{n}$

21. If  $f(x-1) = x^3 - 4x^2 + 3x + 2$ , find  $f(-1)$ .

A. 14

B. 2

C. 0

D. -6

22. The probabilities that Benita will pass French and Twi tests are  $\frac{2}{3}$  and  $\frac{3}{4}$  respectively. If the two events are independent, find the probability that she will fail in one of the subjects.

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

B.  $\frac{5}{12}$

C.  $\frac{1}{6}$

D.  $\frac{1}{12}$

23. Given that  $p = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$  and  $q = \begin{pmatrix} 5 \\ -5 \end{pmatrix}$ , find  $(p-2q)$ .

A.  $\begin{pmatrix} 6 \\ -7 \end{pmatrix}$

B.  $\begin{pmatrix} -6 \\ -7 \end{pmatrix}$

C.  $\begin{pmatrix} 6 \\ 13 \end{pmatrix}$

D.  $\begin{pmatrix} -6 \\ 13 \end{pmatrix}$

24. If  $M = \begin{pmatrix} 2-x & 4-x \\ 3-2x & 1-x \end{pmatrix}$  and  $|M| = -30$ , find

the values of  $x$ .

A. -5, 6

B. -4, 8

C. -3, 7

D. -2, 10

25. If  $y = \frac{5-2x}{4+3x}$ , find  $\frac{dy}{dx}$  when  $x = 1$ .

A.  $\frac{23}{7}$

B.  $\frac{23}{49}$

C.  $-\frac{23}{49}$

D.  $-\frac{23}{7}$

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

A.  $6.17^\circ$

B.  $7.39^\circ$

C.  $8.13^\circ$

D.  $9.11^\circ$

27. Two forces  $F_1 = (3i + 5j) N$  and  $F_2 = (5i - 3j) N$  act on a body of mass 2 kg. Find its acceleration.

A.  $(4i + j) ms^{-2}$

B.  $(2i + 2j) ms^{-2}$

C.  $(4i - j) ms^{-2}$

D.  $(2i - 2j) ms^{-2}$

Turn over



28. Find the coordinates of the centre of the circle  $x^2 + y^2 + 6x - 72 = 0$ .
- A. (3, 0)  
 B. (-3, 0)  
 C. (0, -3)  
 D. (0, 3)
29. Find the coefficient of  $x^4$  in the binomial expansion of  $\left(\frac{1}{2} - 3x\right)^6$ .
- A.  $\frac{1215}{4}$   
 B.  $-\frac{1215}{4}$   
 C.  $-\frac{135}{16}$   
 D.  $\frac{135}{16}$
30. Evaluate:  $\int \sqrt{6x+2} dx$ .
- A.  $\frac{1}{9}(6x+2)^{\frac{3}{2}} + C$   
 B.  $\frac{1}{6}(6x+2)^{\frac{3}{2}} + C$   
 C.  $\frac{1}{6}(\sqrt{6x+2}) + C$   
 D.  $\frac{1}{9}(\sqrt{6x+2}) + C$
31. If  $\frac{3x^2 + 34x - 87}{3x^2 - x - 14} = 1 + \frac{2}{3x-7} + \frac{m}{x+2}$ , find the value of  $m$ .
- A. -11  
 B. -9  
 C. 9  
 D. 11
32. A particle of mass 1 kg which moves with an initial velocity of  $(-2i + 2j) \text{ ms}^{-1}$ , reaches a final velocity of  $(2i + 5j) \text{ ms}^{-1}$ . Find the magnitude of the change in momentum.
- A. 6 Ns  
 B. 5 Ns  
 C.  $3\sqrt{2}$  Ns  
 D.  $2\sqrt{2}$  Ns
33. Find the coefficient of  $x^5$  in the binomial expansion of  $\left(y^3 - \frac{x}{3}\right)^9$ .
- A.  $-\frac{14}{27}y^{12}$   
 B.  $-\frac{14}{27}y^9$   
 C.  $-\frac{7}{9}y^{12}$   
 D.  $-\frac{7}{9}y^9$
34. Consider the following statements:  
 $p$ : It is cold  
 $q$ : It rains  
 Which of the following represents the statements, "whenever it rains, it is cold"?
- A.  $p \wedge q$   
 B.  $q \wedge p$   
 C.  $p \Rightarrow q$   
 D.  $q \Rightarrow p$
35. Given that  $\mu = \{1, 2, 3, \dots, 10\}$ ,  
 $P = \{x : x \text{ is prime}\}$  and  $Q = \{y : y \text{ is odd}\}$ ,  
 find  $P \cap Q$ .
- A. {2}  
 B. {1, 9}  
 C. {3, 5, 7}  
 D. {4, 6, 8, 10}

36. A force of  $180\text{ N}$  acts on a body of mass  $30\text{ kg}$  initially at rest. If it moves a distance of  $147\text{ m}$  along a straight line for  $t$  seconds, find the value of  $t$ .
- A. 14  
B. 12  
C. 7  
D. 6
37. A committee of 4 is to be selected from 5 men and 7 women. Find the probability that the committee is made up of the same sex.
- A.  $\frac{1}{99}$   
B.  $\frac{5}{99}$   
C.  $\frac{7}{99}$   
D.  $\frac{8}{99}$
38. Given that  $f(2x - 3) = 4x^2 + 5x + 2$ , find  $f(1)$ .
- A. 28  
B. 9  
C. 8  
D. 1
39. Find, correct to two decimal places, the variance of the numbers, 7, 4, 10, 6 and 2.
- A. 2.71  
B. 3.68  
C. 6.06  
D. 7.36
40. If  $\sqrt{2}\sin(x) = 1$  for  $90^\circ < x < 180^\circ$ , find the value of  $\frac{1}{1 - \cos(x)}$ .
- A.  $-2 + \sqrt{2}$   
B.  $2 + 2\sqrt{2}$   
C.  $2 - \sqrt{2}$   
D.  $2 - 2\sqrt{2}$

END OF PAPER