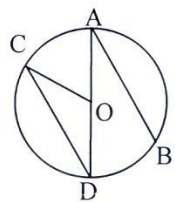


DEFENCE SERVICES ACADEMY
2017-2018 ENTRANCE EXAMINATION
MATHEMATICS TEST

Time Allowed: 2 Hours

ANSWER ALL QUESTIONS

PART (A)

1. Choose the correct or the most appropriate answer for each question.
 Write the letter of the correct or the most appropriate answer. **(22 Marks)**
- (1) An operation \odot is defined by $a \odot b = \frac{3ab}{a+b}$, then the value of a for which $a \odot 2a = 4$ is
 A. -3 B. 3 C. 1 D. -1 E. 2
- (2) If $a - 2$ is a factor of $a^{n+1} + 5a^n - 10a - 36$, then $n =$
 A. 6 B. 5 C. 4 D. 3 E. 2
- (3) ${}^n C_r + {}^n C_{n-r} =$
 A. ${}^n C_{n-1}$ B. $2 {}^n C_r$ C. $2 {}^n C_r$ D. ${}^n C_{n-2r}$ E. none of these
- (4) If the solution set in \mathbb{R} for the inequation $3x^2 + kx - 10 < 0$ is $\left\{x \mid -\frac{2}{3} < x < 5\right\}$, then $k =$
 A. 13 B. -13 C. 5 D. 3 E. 10
- (5) In an A.P., $S_{15} = 240$. Then $U_7 + U_8 + U_9 =$
 A. 48 B. 54 C. 36 D. 72 E. 60
- (6) If $P = \begin{pmatrix} 1+2x \\ 10 \end{pmatrix}$, $Q = \begin{pmatrix} 2 \\ 1-y \end{pmatrix}$ and $P + 2Q = \begin{pmatrix} 3 \\ 2y \end{pmatrix}$, then $\frac{y}{x} =$
 A. -3 B. -2 C. 2 D. 3 E. -4
- (7) If A is an event such that $P(A) = x$ and $P(\text{not } A) = y$, then $x^3 + y^3 =$
 A. $1 + 3xy$ B. $1 - 3xy$ C. $3xy$ D. $3xy - 1$ E. none of these
- (8) In circle O , $AB \parallel CD$ and $\angle BAD = 40^\circ$, then $\angle COD =$
 A. 80° B. 105° C. 100°
 D. 110° E. 120°
- 
- (9) The position vector of A, B, C are \vec{a}, \vec{b} and \vec{c} respectively. If $\vec{AC} = -2\vec{CB}$, then \vec{c} is
 A. $-\vec{a} + 2\vec{b}$ B. $\vec{a} - 2\vec{b}$ C. $2\vec{a} + \vec{b}$ D. $2\vec{a} - \vec{b}$ E. $-2\vec{a} + \vec{b}$
- (10) The smallest value of x for which $\tan 3x = -1$ is
 A. 15° B. 45° C. 135° D. 90° E. 105°
- (11) The stationary point of the curve $y = x^2 - 4x$ is
 A. (2, 4) B. (2, 0) C. (2, -4) D. (-2, 4) E. (0, 4)

P.T.O. →

PART (B)

2. (a) A binary operation \odot on \mathbb{N} is defined by $x \odot y =$ the remainder when x^y is divided by 5. Is the binary operation commutative? Find the value of $[(2 \odot 3) \odot 4] + [2 \odot (3 \odot 4)]$. Is the binary operation associative? **(6 marks)**
- (b) The expression $6x^3 + ax^2 + bx + 10$ has factor $2x - 1$ but leaves a remainder -20 when divided by $x + 2$. Find a, b and factorize the expression completely. **(7 marks)**
3. (a) Find the coefficients of x^0 and x^3 respectively in the expansions of $\left(x - \frac{1}{x^2}\right)^9$. Are they equal? **(6 marks)**
- (b) Find the solution set of the inequation $12 - 25x + 12x^2 \leq 0$ by graphical method and illustrate it on the number line. **(7 marks)**
4. (a) The sum of the first three terms of a G.P. is 27 and the sum of the fourth, fifth and sixth terms is -1 . Find the common ratio and the sum to infinity of the G.P. **(6 marks)**
- (b) Use the matrix method to find the solution set of the system of equations:
 $3x - 7y = 44$ and $8y + 2x + 34 = 0$. **(7 marks)**
5. (a) Draw a tree diagram to list all possible outcomes for a family which has three children. Find the probability that (i) only the first child is a girl (ii) the last child is a girl (iii) the last two children born are girls. **(6 marks)**
- (b) AB is a chord joining the points of contact A, B of tangents PA, PB to a circle whose centre is O. Prove that P, B, O, A are concyclic. If the lengths of the tangents be each equal to AB, find $\angle AOB$. **(7 marks)**
6. (a) In $\triangle ABC$, AD and BE are the altitudes. If $4\alpha(\triangle DEC) = 3\alpha(\triangle ABC)$, find $\angle ACB$. **(6 marks)**
- (b) The coordinates of A, B and C are (1,3), (5,4) and (1,9) respectively. Find the coordinates of D if ABCD is a parallelogram. **(7 marks)**
7. (a) Calculate $\lim_{x \rightarrow 2} \frac{x^3 - 8}{\sqrt{x+2} - 2}$, $\lim_{x \rightarrow 0} \frac{\cos x - 1}{\sin^2 x}$ and $\lim_{x \rightarrow 2} \frac{x^3 - 8}{x^2 + 3x - 10}$. **(6 marks)**
- (b) If $\alpha + \beta + \theta = \pi$, show that $\sin \alpha - \sin \beta + \sin \theta = 4 \sin \frac{\alpha}{2} \cos \frac{\beta}{2} \sin \frac{\theta}{2}$. **(7 marks)**