

**DEFENCE SERVICES TECHNOLOGICAL ACADEMY
ENTRANCE EXAMINATION
MATHEMATICS**

Date: 19-8-2017

Time Allowed: 2 Hours

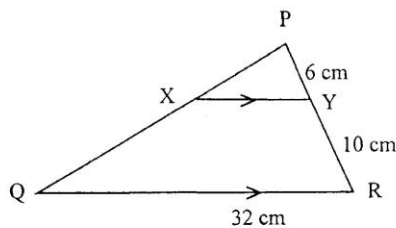
Attempt All Questions

1. Choose the correct or the most appropriate answers for each question. Write only the letter of the answer. (30 Marks)

- (1) Let a function f be defined by $f(x) = 7 - \frac{5}{x}$, $x \neq 0$, Then f' is undefined at $x =$
 A. 6 B. 7 C. 8 D. 9 E. 5
- (2) An operation e on R is defined by $x e y = 3x(x + 3y)$ for all real numbers x and y . If $a e 1 = 30$, then the positive value of $a =$
 A. -2 B. -5 C. 0 D. 2 E. 5
- (3) Let $f: R \rightarrow R$ and $g: R \rightarrow R$ be defined by $f(x) = 3x - 1$, $g(x) = x + 7$. Then $(g^{-1} \circ f)(2) =$
 A. 1 B. -1 C. 2 D. -2 E. 3
- (4) If $1 + 3x + 5x^2 + 7x^3 + \dots + 31x^{15}$ is divided by $x - 1$, then the remainder is
 A. 256 B. 240 C. 47 D. -16 E. -32
- (5) The remainder when $f(x)$ is divided by $2x$ is
 A. $f(2)$ B. $f(0)$ C. $f(\frac{1}{2})$ D. $f(-2)$ E. none of these
- (6) If $x^2 - 1$ is a factor of $x^3 + 2x^2 + bx + a$, then $b =$
 A. 1 B. 2 C. 3 D. -1 E. -2
- (7) The coefficient of the middle term in the expansion of $(x^2 + \frac{2}{x})^6$ is
 A. -120 B. 125 C. 240 D. -240 E. 160
- (8) The sum of all the coefficients of the terms in the expansion of $(x-1)^{10}$ is
 A. 0 B. 1 C. 6 D. 11 E. 5
- (9) The constant term in the expansion of $(2x - \frac{1}{x^2})^6$ is
 A. 240 B. 30 C. -240 D. -30 E. 30
- (10) The parabola $y = 12x^2 - 25x + 12$ cuts the x axis at A and B. The distance between A and B is
 A. 2 B. $\frac{7}{4}$ C. $\frac{7}{12}$ D. $-\frac{7}{12}$ E. $-\frac{7}{4}$
- (11) The solution set of the inequality $x^2 + (1-k)x - k \leq 0$, where $k > -1$ is
 A. ϕ B. $\{-1\}$ C. $\{x/x \leq -1 \text{ or } x \geq k\}$ D. $\{x/-1 \leq x \leq k\}$ E. none of these
- (12) The solution set in R of $(x-3)^2 \geq 0$ is
 A. R B. $R \setminus \{3\}$ C. ϕ D. $\{x/x \geq 3\}$ E. $\{x/x \leq 3\}$
- (13) Given that $3, x, y, z, 23, \dots$ is an arithmetic sequence, then $z =$
 A. 13 B. 18 C. 21 D. 22 E. none of these
- (14) Which term of the G.P 1, 2, 4, ... is 256?
 A. 7th term B. 8th term C. 9th term D. 10th term E. 11th term
- (15) If $(x+1 - x^2) = (2 - 1)$, then $x =$
 A. 0 B. -1 C. 1 D. 2 E. ± 1
- (16) Given that $P = \begin{pmatrix} x & 8 \\ 2 & x \end{pmatrix}$ is singular and $Q = \begin{pmatrix} 1 & x \\ 1 & -4 \end{pmatrix}$ is non-singular, then $x =$
 A. ± 2 B. ± 4 C. 4 D. -4 E. 2
- (17) If $P(\text{not } A) = n P(A)$ then $P(A) =$
 A. n B. $n+1$ C. $\frac{1}{n}$ D. $\frac{1}{n+1}$ E. n^2
- (18) A coin is tossed 3 times and a die is rolled once. The number of possible outcomes is
 A. 6 B. 8 C. 12 D. 24 E. 48
- (19) A coin is tossed k times. If the probability getting no tail is $\frac{1}{512}$, then $k =$
 A. 5 B. 7 C. 9 D. 6 E. 8
- (20) In a cyclic quadrilateral $ABCD$, $\angle A - \angle C = 20^\circ$. Then $\angle C =$
 A. 60° B. 80° C. 90° D. 100° E. 120°
- (21) The angle in the semicircle is
 A. 30° B. 60° C. 360° D. 90° E. 180°

- (22) The areas of two similar triangles are 25 cm^2 and 36 cm^2 respectively. Then the ratio of the altitudes is
 A. 5:6 B. 4:9 C. 2:3 D. 8:9 E. 4:3
- (23) The ratio of the sides of two equilateral triangles is 3:1, then the ratio of their area is
 A. 3:1 B. 9:1 C. 1:9 D. 1:3 E. 4:9
- (24) If \vec{a}, \vec{b} are non-parallel and non-zero such that $(3x+y)\vec{a} + (y-3)\vec{b} = \vec{0}$, then $x =$
 A. 1 B. -1 C. 3 D. -3 E. none of these
- (25) The coordinates of P, Q and R are $(1, 2), (7, 1)$ and $(-3, 7)$ respectively. If O is the origin and $\vec{OR} = h\vec{OP} + k\vec{OQ}$, then $(h, k) =$
 A. $(1, 4)$ B. $(2, 1)$ C. $(-1, 4)$ D. $(4, -1)$ E. $(-4, 1)$
- (26) $\tan(-135^\circ) + \cot 315^\circ =$
 A. 1 B. 2 C. -1 D. 0 E. none of these
- (27) $2 \sin 37^\circ \cos 37^\circ =$
 A. $\sin 74^\circ$ B. $\cos 74^\circ$ C. $\sin 0^\circ$ D. $\cos 0^\circ$ E. none of these
- (28) The stationary point of the curve $y = x^2(3-x), x > 0$ is
 A. $(0, 3)$ B. $(2, 4)$ C. $(2, 2)$ D. $(-2, 2)$ E. $(1, 3)$
- (29) The stationary point of the curve $y = x^2 - 4$ is
 A. $(2, 4)$ B. $(2, 0)$ C. $(-2, 12)$ D. $(0, 4)$ E. $(2, -4)$
- (30) The gradient of normal line to the curve $y = 2\sqrt{x}$ at the point $x = 9$ is
 A. $\frac{1}{3}$ B. $-\frac{1}{3}$ C. 3 D. -3 E. 6

2. The functions f and g are defined by $f(x) = 3x - 1$ and $g(x) = \frac{3x+2}{x-1}, x \neq 1$. Find the inverse functions f^{-1} and g^{-1} . Evaluate $(g \circ f^{-1})(5)$ and $(f \circ g^{-1})(2)$. (10 marks)
3. Given that the equation $2x^3 + ax^2 + bx - 12 = 0$ has roots $x = 1$ and $x = 4$. Find the values of a, b and the third root. (10 marks)
- 4 (a) Find the solution set of the inequation $12 + x - x^2 \geq 0$ by graphical method. (5 marks)
 (b) Find the solution set of the inequation $(2x + 3)(x + 2) > 0$. (5 marks)
5. The sum of the first 4 terms of an A.P is 30. The sum of the squares of the 2nd and 3rd terms is 117. Find the first four terms and the n^{th} terms of that A.P. (10 marks)
6. A box contains 5 marbles, 3 are blue, 1 white and 1 red. Two marbles are drawn one after another without replacement. Draw a tree diagram to describe the possible outcomes. Find the probabilities of at least one blue marble, exactly one blue marble and at most one blue marble. (10 marks)
7. In $\triangle PQR$, $QR = 32 \text{ cm}$. The point Y on PR is such that $PY = 6, YR = 10 \text{ cm}$. The point X on PQ is such that $XY \parallel QR$. Find the length of XY . If $\alpha(\triangle PXY) = 27 \text{ cm}^2$, find $\alpha(\triangle QXYR)$. (10 marks)



8. If the perimeter of a rectangle is 20 m, show that the area is the greatest when the rectangle is a square. (10 marks)
