DEFENCE SERVICES TECHNOLOGICAL ACADEMY
ENTRANCE EXAMINATION for TWENTY SECOND INTAKE

MATHEMATICS (SET A) **Time Allowed : (2) Hours**

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

(1) A function *f* is defined by $(x) = \frac{x-5}{x-3}$. The value of *x* for which *f* is not defined is
A. -3 B. 3 C. 5 D. -5 E. 0

(2) Given that $(x) = \frac{1-x-x^2}{1+x}$, then *f(-1)* =
A. $\frac{1}{2}$ B. $-\frac{1}{2}$ C. 2 D. -2 E. undefined

(3) Given that $f(x)=x^3-6$, find $-f(-x)$
A. $-x^3-6$ B. $-x^3+6$ C. 0 D. x^3-6 E. x^3+6

(4) In the expansion of $(1+kx)^{20}$, the coefficient of x^2 is 19. The positive value of k is
A. $\frac{1}{10}$ B. $\frac{1}{\sqrt{10}}$ C. 10 D. $\sqrt{10}$ E. non of these

(5) If x^3-3x^2-4x+p is divisible by x-2, then the value of p is
A. 10 B. 12 C. 24 D. -24 E. -12

(6) When $x^{1-n}-7x^2-30$ is divided by x-3, the remainder is 150, then the value of n is
A. 5 B. -3 C. 3 D. 4 E. -4

(7) The middle term in the expansion of $(1-\frac{1}{x})^8$ is
A. $70x^{-4}$ B. $-70x^{-4}$ C. $56x^{-5}$ D. $-56x^{-5}$ E. non of these

(8) In the expansion of $(p-2)^6$, the coefficient in the middle term is
A. -160 B. 160 C. -240 D. 240 E. non of these

(9) The solution set in R for the inequation $-2x^2 \le 0$ is
A. $\{x/x \le 3\}$ B. ϕ C. $\{x/x > 0\}$ D. $\{x/x < 0\}$ E. R

(10) The solution set of $x^2 - x \le x(x-1)$ is
A. {0} B. {0, -1} C. {1, 0} D. R E. ϕ

(11) The solution set in R of $x^2-4x-5>0$ is
A. {x/-1<x<5} B. ϕ C. {x/x<-1} D. {x/x>5} E. {x/x<-1 or x>5}

(12) The formula for the sum to n terms in an A.P. is S_n=
A. a+(n-1)d B. a-(n+1)d C. a-(n-1)d D. $\frac{n}{2}\{2a+(n-1)d\}$ E. $\frac{n}{2}\{2a-(n-1)d\}$

(13) In a G.P. , the fourth term is 16 and the seventh term is 128. Then the common ratio is
A. 4 B. -2, C. 2 D. -4 E. 8

(14) Given that 7, a, b, c, -5 is an A.P, then the median of a, b, c is
A. -2 B. 1 C. $\frac{3}{2}$ D. 3 E. 4

(15) $X = \begin{bmatrix} 1 & 0 \\ 2 & 3 \end{bmatrix}, X - KI$ is singular, then K=
A. 1 only B. 2 only C. 3 only D. -1 or -3 E. 1 or 3

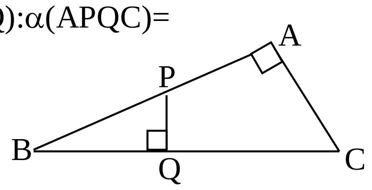
(16) If $\begin{bmatrix} 7 & 2k+1 \\ 2 & 3 \end{bmatrix}$ is singular, then 4k+1=
A. 20 B. 19 C. 21 D. 22 E. 23

(17) Two fair coins are tossed. The probability of getting two heads is
A. 1 B. $\frac{1}{2}$ C. $\frac{3}{4}$ D. $\frac{1}{4}$ E. 0

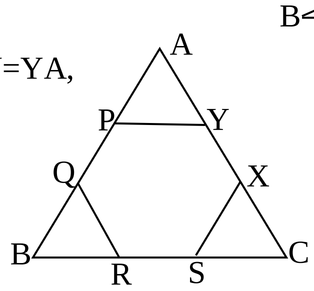
(18) A, B and C are three events such that the mean of P(A), P(B) and P(C) = $\frac{7}{12}$.
Then P(not A)+ P(not B)+P(not C)=
A. $\frac{5}{12}$ B. $\frac{8}{12}$ C. $\frac{10}{12}$ D. $\frac{15}{12}$ E. $\frac{21}{12}$

(19) Student A takes a mathematics contest, the probability that his score will be at least 80% is 0.45 and the probability that his score will be exactly 80% is 0.15. Then the probability that the score of A will be at most 80% is
A. 0.55 B. 0.6 C. 0.65 D. 0.7 E. 0.75

(20) In the figure ∠A=90°, PQ⊥BC, AC=5, BC=13 and CQ=7. Then α(ΔBPQ):α(APQC)=
A. 1:2 B. 1:3 C. 1:4
D. 1:9 E. 4:9



(21) In the Figure AP=PQ=QB, BR=RS=SC and CX=XY=YA,
then α(PQRSXY): α(ΔABC)=
A. 1:2 B. 1:3 C. 1:9
D. 2:3 E. 4:9



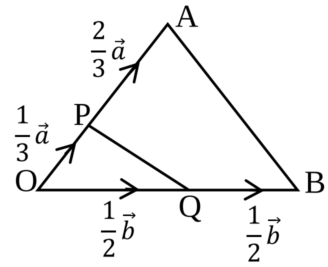
(22) The lengths x_1, x_2, x_3 of corresponding sides of the three similar triangles Δ_1, Δ_2, Δ_3 respectively form and A. P and $\alpha(\Delta_1)+\alpha(\Delta_2)=\alpha(\Delta_3)$, then $x_1:x_3=$

A. 4:5 B. 2:3 C. 3:4 D. 3:5 E. 5:3

(23) In ΔOAB, P is a point on OA such that OP:PA=1:2 and Q is the mid-point of OB. $\overrightarrow{OA}=\vec{a}$, $\overrightarrow{OB}=\vec{b}$, then $\overrightarrow{PQ}=$

A. $\frac{1}{3}\vec{a}+\frac{1}{2}\vec{b}$ B. $\frac{1}{2}\vec{a}+\frac{1}{3}\vec{b}$ C. $\frac{2}{3}\vec{a}-\frac{1}{2}\vec{b}$

D. $-\frac{2}{3}\vec{a}+\frac{1}{2}\vec{b}$ E. $-\frac{1}{3}\vec{a}+\frac{1}{2}\vec{b}$



(24) In any ΔABC, sin (A+B)=

A. -sin C B. sec (90°+C) C. sin (90°-C) D. cos (90°-C) E. –cos C

(25) If $\log(\cos\theta)=p$ then $\log(\sec\theta)=$

A. –p B. 1-p C. $\frac{1}{p}$ D. $-\frac{1}{p}$ E. p

(26) In ΔABC, $\angle A:\angle B:\angle C=3:4:5$, then a:b

A. $1:\sqrt{2}$ B. 1:2 C. $1:\sqrt{3}$ D. $2:\sqrt{3}$ E. $2:\sqrt{6}$

(27) In ΔABC, a:b:c = $1:3:\sqrt{7}$ then $\angle C=$

A. 30° B. 45° C. 60° D. 75° E. 90°

(28) If x+y=10, then the maximum value of xy is

A. 100 B. 10 C. 25 D. 9 E. 24

(29) $\lim_{x\to\pi}\frac{\sin x}{x-\pi}=$

A. -3 B. -2 C. -1 D. 1 E. 2

(30) If $f(x)=x\sin x$, then $f'(0)=0$

A. 2 B. 1 C. 0 D. -1 E. -2

2. Function f and $g.f^{-1}$ are defined by $f:x\mapsto 2x+3$ and $(g.f^{-1}):x\mapsto\frac{8}{x-3}$, $x\neq3$. Find in similar form,

(i) f.f,

(ii) g. (10 Marks)

3. When $2x^3-x^2-16x-1$ is divided by x^2-x-6, the quotient is $Q(x)$ and the remainder is $(ax+b)$. (10 Marks)

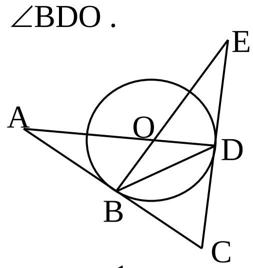
(i) State the degree of the quotient $Q(x)$.

(ii) Find the value of a and b.

4. Given that $2x-14$, $x-4$ and $\frac{1}{2}x$ are three consecutive terms of a G.P., if $2x-14$ is the 3rd term of a G.P. with infinite terms, find the sum to infinity. (10 Marks)

5. Three tennis players A, B and C play each other only once. The probability that A will beat B is $\frac{3}{5}$, that B will beat C is $\frac{2}{3}$ and A will beat C is $\frac{5}{7}$. Calculate the probability that B wins both games. What is the probability that A will not win both games? (10 Marks)

6. O is the center of the circle and AC and CE are tangents to the circle at B and D respectively. $\angle BAO=40°$. Find (i) $\angle DEO$, (ii) $\angle BCD$, (iii) $\angle BDO$. (10 Marks)



7. Prove that $\cos 2\theta=\frac{1-\tan^2\theta}{1+\tan^2\theta}$, Hence deduce that $\tan 22\frac{1}{2}°=\sqrt{2}-1$. (10 Marks)

8. Differentiate $y=\frac{1}{x^2}$ with respect to x at x=2 from the first principles. (10 Marks)