Sample Paper-02
Mathematics
Class – XI

ANSWERS

Section A

1. **Solution :**

$$f(x) = a^x$$

$$f(y) = a^y$$

$$f(x).f(y) = a^x.a^y = a^{x+y} = f(x).f(y)$$

2. **Solution :**

When $x = 0, y = 1$ in both cases. Hence

$$(A \cap B) = \{0,1\}$$

3. **Solution :** 2^{pq}

4. **Solution**

They are parallel since

$$\begin{vmatrix} a & -b \\ \frac{a}{2} & \frac{-b}{2} \end{vmatrix} = 0$$

5. **Solution**

Area of a triangle

$$\frac{1}{2}\begin{vmatrix} 2-2 & 0-6 \\ 5-2 & 3-6 \end{vmatrix} = \frac{1}{2}\begin{vmatrix} 0 & -6 \\ 3 & -3 \end{vmatrix} = 9$$

6. **Solution**

$$x^2 + y^2 = 25$$

Section B

7. **Solution:**

$$\cos 3x = \cos\frac{2\pi}{3}$$

$$3x = 2n\pi \pm \frac{2\pi}{3}$$

$$x = \frac{2n\pi}{3} \pm \frac{2\pi}{9}, n \in Z$$

8. **Solution:**

Let $P(n)$ be the statement given by $1+2+3+........+n=\frac{n(n+1)}{2}$

$$P(1)=\frac{1(1+1)}{2}$$

=1, True

Let it be true for n=m

$$1+2+3+....:.+m=\frac{m(m+1)}{2}$$

$$1+2+3+....:.+m+(m+1)=\frac{m(m+1)}{2}+(m+1)$$

$$P(m+1)=\frac{m(m+1)}{2}+(m+1)$$

$$P(m+1)=\frac{m^2+3m+2}{2}$$

$$P(m+1)=\frac{(m+1)(m+2)}{2}$$

$Thus\ P(m)\ is\ true \Rightarrow P(m+1)\ is\ True$

9. **Solution:**

Let $\sqrt{z}$ = $\sqrt{-8i}$

$$\sqrt{z}=\pm\{\frac{\sqrt{|z|-Re(z)}}{\sqrt{2}}\}-i\{\frac{\sqrt{|z|-Re(z)}}{\sqrt{2}}\}, Im(z)<0$$

$$\sqrt{-8i}=\pm\{\frac{\sqrt{8+0}}{\sqrt{2}}-i\frac{\sqrt{8-0}}{\sqrt{2}}\}, Im(z)<0$$

$$=\pm(2-2i)$$

10. **Solution**

$$\frac{2x+5}{x-2}-3\geq 0$$

$$=\frac{2x+5-3x+6}{x-2}\geq 0$$

$$=\frac{-x+11}{x-2}\geq 0$$

$$=\frac{x-11}{x-2}\leq 0$$

$$=(x-11)(x-2)\leq 0$$

$$x\in(2,11]$$

11. **Solution**

$$x+x+4=12$$

$$2x=8$$

$$x=4$$

12. **Solution**

Let p be the probability of winning Car C, $P(C)$

P(C) = p

P(B) = 2p

P(A) = 6p

P(A) + P(B) + P(C) = 1

p + 2p + 6p = 1

9p = 1

$$p=\frac{1}{9}$$

$$P(C)=\frac{1}{9}$$

$$P(B)=\frac{2}{9}$$

$$P(A)=\frac{6}{9}$$

13. **Solution :**

Let a satisfy the relation $f(a)=3$

$$f(f(a)).(1+f(a))=-f(a)$$

$$f(3).(4)=-3$$

$$f(3)=-\frac{3}{4}$$

14. **Solution:**

$$\tan(A+B)=\frac{\tan A+\tan B}{1-\tan A\tan B}$$

$$=\frac{\frac{1}{3}+\frac{1}{2}}{1-\frac{1}{3}.\frac{1}{2}}$$

$$=1$$

$$A+B=45$$

$$2(A+B)=90$$

$$\sin 90=1$$

15. **Solution**:

Form a quadratic equation sum of whose roots are 30 and product of the roots is 81

$$x^2-x(30)+81=0$$

$x^2 - 3x - 27x + 81 = 0$

$x(x-3) - 27(x-3)$

$(x-3)(x-27) = 0$

Hence the numbers are 3 and 27

16. **Solution:**

Let $f : R \to R$ be a function given by $f(x) = x^2 + 2$ find $f^{-1}(27)$

$f(x) = x^2 + 2$

$x^2 + 2 = 27$

$x^2 = 25$

$x = \pm 5$

$f^{-1}(27) = \{-5, 5\}$

17. **Solution:**

The function is defined for all values of x where the denominator is not equal to zero

$a + 1 - x \neq 0$

Hence domain =

$R - \{(a+1)\}$

Range of f

Let $y = f(x)$

$$y = \frac{x-a}{a+1-x}$$

$(a+1)y - xy = x - a$

$x(y+1) = (a+1)y + a$

$$x = \frac{(a+1)y + 2}{y+1}$$

Range of $f = R - \{-1\}$

18. **Solution**

Rationalize the numerator

$$\lim_{x \to 0} \frac{\sqrt{a+x} - \sqrt{a}}{x}$$

$$= \lim_{x \to 0} \frac{(\sqrt{a+x} - \sqrt{a})(\sqrt{a+x} + \sqrt{a})}{x(\sqrt{a+x} + \sqrt{a})}$$

$$= \lim_{x \to 0} \frac{x}{x(\sqrt{a+x} + \sqrt{a})}$$

$$= \frac{1}{2\sqrt{a}}$$

19. **Solution:**

$$\sin 75^0 + \cos 75^0$$
$$= \sqrt{2}\left(\frac{1}{\sqrt{2}}\sin 75^0 + \frac{1}{\sqrt{2}}\cos 75^0\right)$$
$$= \sqrt{2}(\cos 45^0 \sin 75^0 + \sin 45^0 \cos 75^0)$$
$$= \sqrt{2}\sin(75^0 + 45^0)$$
$$= \sqrt{2}\sin 120^0$$

Hence sign is positive and value is $\frac{\sqrt{2}.\sqrt{3}}{2} = \frac{\sqrt{6}}{2}$

Section C

20. **Solution:**

There are 4 groups and four groups can be arranged in $4!$ ways. Class 12 can be arranged in $3!$ ways , Class 11 can be arranged in $4!$ Class 10 can be arranged in $4!$. Class 9 can be arranged in $2!$ ways

Hence Total number of ways that they can be arranged in a row $4! \times 3! \times 4! \times 4! \times 2! = 165888$

In a circular seating arrangement the four groups can be arranged only in $3!$ ways only. Hence the total number of ways that they can be seated at a round table = $3! \times 3! \times 4! \times 4! \times 2! = 41472$

21. **Solution**

The new coordinates of the centre in the new position are

$$(a + 4\pi r, b)$$
$$\{x - (a + 4\pi r)\}^2 + (y - b)^2 = r^2$$

22. **Solution**

$$x^2 + 4y^2 + 4x + 16y + 16 = 0$$
$$x^2 + 4x + 4 + 4y^2 + 16y + 16 = 4$$
$$(x+2)^2 + 4(y+2)^2 = 4$$
$$\frac{(x+2)^2}{2^2} + \frac{(y+2)^2}{1^2} = 1$$

This equation represents an ellipse.

23. **Solution**

x_i	f_i	$f_i x_i$	$\lvert x_i - 15\rvert$	$f_i \lvert x_i - 15\rvert$
2	12	24	13	156
15	6	90	0	0
17	12	204	2	24
23	9	207	8	72

27	5	135	12	60
	$N=\Sigma f_i=44$	$\Sigma f_i\ x_i=660$		$f_i\Sigma\|x_i-15\|=312$

$$Mean=\bar{X}=\frac{1}{N}(\Sigma f_i\ x_i)=\frac{660}{44}=15$$

$$MeanDeviation=M.D=\frac{1}{N}(\Sigma f_i\ |x_i-15|)=\frac{312}{44}=7.0909$$

24. **Solution**

Let the ratios be

$a : b$

$x^2+px+q=0$

$a\alpha+b\alpha=-p$

$a\beta+b\beta=-p_1$

$a\alpha\times b\alpha=q$

$a\beta\times b\beta=q_1$

$(a+b)\alpha=-p$

$(a+b)\beta=-p_1$

$ab\alpha^2=q$

$ab\beta^2=q_1$

$$\frac{(a+b)^2\alpha^2}{(a+b)^2\beta^2}=\frac{p^2}{p_1^2}$$

$$\frac{\alpha^2}{\beta^2}=\frac{p^2}{p_1^2}$$

$$\frac{\alpha^2}{\beta^2}=\frac{q}{q_1}$$

$$\frac{p^2}{p_1^2}=\frac{q}{q_1}$$

$p^2q_1=p_1^2q$

25. **Solution** :

$$1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\ldots\ldots\infty=\frac{1}{1-\frac{1}{2}}=\frac{1}{\frac{1}{2}}=2$$

$$a.a^{\frac{1}{2}}.a^{\frac{1}{4}}.a^{\frac{1}{8}}\ldots\ldots\infty=a^2$$

26. **Solution**

It is given that

$n(U)=700$, $n(A)=200$, $n(B)=295$, $n(A\cap B)=115$

We need to find out

$n(A'\cap B')$

$$n(A'\cap B')=n(A\cup B)'$$
$$=n(U)-n(A\cup B)$$
$$=n(U)-\{n(A)+n(B)-n(A\cap B)\}$$
$$=700-\{200+295-115\}$$
$$=320$$