Sample Paper-02 (solved)
Mathematics
Class – XI

ANSWERS

Section A

1. Solution

They are parallel since

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

2. Solution

Area of a triangle

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

3. Solution

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

4. Solution :

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

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

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

5. Solution :

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

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

6. Solution : 2^{pq}

Section B

7. Solution :

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

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

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

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

8. Solution:

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

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

$$=1$$

$$A+B=45$$

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

$$\sin 90=1$$

9. **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

10. **Solution:**

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

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

$$x^2+2=27$$

$$x^2=25$$

$$x=\pm 5$$

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

11. **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 $f \ = R - \{-1\}$

12. Solution

Rationalize the numerator

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

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

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

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

13. 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 $\frac{\sqrt{2}.\sqrt{3}}{2}$ = $\frac{\sqrt{6}}{2}$

14. Solution:

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

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

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

15. Solution:

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

$$P(1)=\frac{1(1+1)}{2}$$
$$=1, True$$
$$Let\ it\ betrue\ \ for\ n=m$$
$$1+2+3+\ldots.:.+m=\frac{m(m+1)}{2}$$
$$1+2+3+\ldots.:.+m+(m+1)=\frac{m(m+1)}{2}+(m+1)$$
$$P(m+1)=\frac{m(m+1)}{2}+(m+1)$$
$$P(m+1)=\frac{m^2+3m+2}{2}$$
$$P(m+1)=\frac{(m+1)(m+2)}{2}$$
$$Thus\ P(m)\ is\ true \Rightarrow P(m+1)\ is\ True$$

16. Solution:

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

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

17. Solution

$$\frac{2x+5}{x-2}-3\geq 0$$
$$=\frac{2x+5-3x+6}{x-2}\geq 0$$
$$=\frac{-x+11}{x-2}\geq 0$$
$$=\frac{x-11}{x-2}\leq 0$$
$$=(x-11)(x-2)\leq 0$$
$$x\in(2,11]$$

18. Solution

$x + x + 4 = 12$

$2x = 8$

$x = 4$

19. Solution

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

$P(C) = p$

$P(B) = 2p$

$P(A) = 6p$

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

$p + 2p + 6p = 1$

$9p = 1$

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

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

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

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

Section C

20. Solution

Let the ratios be

$a : b$

$x^2 + px + q = 0$

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

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

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

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

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

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

$ab\alpha^2 = q$

$ab\beta^2 = q_1$

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

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

$$p^2 q_1 = p_1^2 q$$

21. **Solution** :

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

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

22. **Solution**

It is given that

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

We need to find out

$n(A'\cap B')$

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

23. **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 = $3!\times 3!\times 4!\times 4!\times 2! = 41472$

24. **Solution**

The new coordinates of the centre in the new position are

$(a+4\pi r\ ,b)$

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

25. 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.

26. 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
	$N=\Sigma f_i=44$	$\Sigma f_i\ x_i=660$		$f_i\Sigma\lvert x_i-15\rvert=312$

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

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