BYJU'S Home Learning Program

Topic covered:

- **Mathematical Tools (Session - 1) - JEE**

Worksheet

1. Find the equation of the line whose slope is 3 and y intercept is -4.
   a. $y = 2x - 3$
   b. $y = 3x + 4$
   c. $y = 3x - 4$
   d. $y = \sqrt{3x} - 0$

2. Find the equation of the line parallel to the line passing through $(5,7)$ and $(2,3)$ and having x intercept as -4.
   a. $3y = 4x - 16$
   b. $4y = 3x - 16$
   c. $3y = 4x + 16$
   d. $4y - 3x + 16$

3. What is the slope of the line passing through the points $(-2, 3)$ and $(2, 7)$?
   a. 1
   b. -1
   c. 2
   d. -2

4. In which quadrant does the point $(-3, 4)$ lie?
   a. 1^{st}
   b. 2^{nd}
   c. 3^{rd}
   d. 4^{th}

5. Find the co-ordinate of the point(s) on x-axis, which is/are at a distance of 5 units from the point $(6, -3)$.
   a. $(2, 0)$ and $(10, 0)$
   b. $(0, 2)$ and $(0, 10)$
   c. $(2, 10)$ and $(0,\ 0)$
   d. None of these

6. The quadrants where abscissa and ordinate have different signs are?
   a. 1^{st} & 2^{nd}
   b. 2^{nd} & 3^{rd}
   c. 1^{st} & 3^{rd}
   d. 2^{nd} & 4^{th}

7. What is equation of a line passing through the points $(4, 2)$ and $(15, -4)$?

8. Find the exact value of $\cos 15^{o}$.

9. $f(x) = x^2 + 32x - 12$. What is $f(4)$?

10. Show that $(1 - \cos^2\theta)\operatorname{cosec}^2\theta = 1$

11. Show that $\tan^4\theta + \tan^2\theta = \sec^4\theta - \sec^2\theta$

12. Find the value of $\cos(24^o) + \cos(5^o) + \cos(175^o) + \cos(204^o) + \cos(300^o)$
13. Function f is defined by $f(x) = 2x^2 + 6x - 3$. Find the value of $f(-2)$.
14. How many unique solutions does the equation $4x^2 + 4x + 1 = 0$ have?
15. What is the degree of the polynomial $x^2(x^3)^2$?
16. Solve: $x^2 - 5x - 14 = 0$
17. Find: $\cos\alpha, \cot\alpha, \tan\alpha$ respectively if $\sin\alpha = \frac{5}{13}$ and $\frac{\pi}{2} < \alpha < \pi$
18. Calculate $\sin 15^0 \cos 15^0$.
19. Height of a body in meters is given by $h(t) = 10\sin(2\pi t) + 5$. Find its height at $t = 0.25\ s$.
20. Find the nature of roots for the equation $x^2 + x + 12 = 0$

Answer Key

Question Number	1	2	3	4	5	6
Answer Key	(c)	(c)	(a)	(b)	(a)	(d)

Question Number	7	8	9	12	13	14
Answer Key	$6x + 11y = 46$	$\frac{\sqrt{3}+1}{2\sqrt{2}}$	132	$\frac{1}{2}$	-7	One

Question Number	15	16	17	18	19	20
Answer Key	8	$(7, -2)$	$-\frac{12}{13}, -\frac{12}{5}, -\frac{5}{12}$	$\frac{1}{4}$	15	Complex roots

BYJU'S Home Learning Program

Solutions

1. (c)
   Given $m = 3$ and $c = -4$, substituting values in $y = mx + c$, we get $y = 3x - 4$.

2. (c)
   Slope of the given line $= \frac{7-3}{5-2} = \frac{4}{3}$
   So the slope of the required line is also $\frac{4}{3}$. One point on this line is $(-4, 0)$. Hence the equation of the line is
   $y - 0 = \frac{4}{3}(x + 4) \Rightarrow 3y = 4x + 16$

3. (a)
   $$\frac{7-3}{2-(-2)} = 1$$

4. (b)
   The point is negative in the x axis and positive for the y-axis, thus the point must lie in the 2nd quadrant.

5. (a)
   Let the co-ordinate of the point on the x-axis be $(x, 0)$.
   $d^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$,
   So $5^2 = (x-6)^2 + \big(0-(-3)\big)^2$
   $\Rightarrow 25 = x^2 - 12x + 36 + 9$
   $\Rightarrow x = 2$ or $x = 10$
   So the required points are $(2, 0)$ and $(10, 0)$

6. (d)
   The signs are different for 2nd and 4th quadrants.

7. $\frac{2+4}{4-15} = \frac{y-2}{x-4}$
   $6x + 11y = 46$

8. $\cos 15^o = \cos(45^o - 30^o) = \cos 45^o \cos 30^0 + \sin 45^o \sin 30^o = \frac{\sqrt{3}+1}{2\sqrt{2}}$

9. $f(x) = x^2 + 32x - 12$
   $f(4) = 4^2 + 32(4) - 12$
   $= 16 + 128 - 12$
   $= 132$

10. Let A $= (1 - \cos^2\theta)\text{cosec}^2\theta$ and B $= 1$.
    $$A = (1 - \cos^2\theta)\text{cosec}^2\theta$$
    Because $\sin^2\theta + \cos^2\theta = 1$, we have
    $$\sin^2\theta = 1 - \cos^2\theta$$
    Then,
    $$A = \sin^2\theta . \cos^2\theta$$
    $$A = \sin^2\theta . (1/\sin^2\theta)$$
    $$A = \sin^2\theta/\sin^2\theta$$

$A = 1$
$A = B$ (Proved)

11. Let $A = \tan^4\theta + \tan^2\theta = \sec^4\theta - \sec^2\theta$
$A = \tan^4\theta + \tan^2\theta$
$A = \tan^2\theta \times (\tan^2\theta + 1)$
We know that,
$\tan^2\theta = \sec^2\theta - 1$
$\tan^2\theta + 1 = \sec^2\theta$
Then,
$A = (\sec^2\theta - 1)(\sec^2\theta)$
$A = \sec^4\theta - \sec^2\theta$
$A = B$ Proved

12. $\cos(175^o) = \cos(180 - 5)^0 = -\cos(5)^0$
$\cos(204^o) = \cos(180 + 24)^0 = -\cos(24)^0$
$\cos(300^o) = \cos(360 - 60)^0 = \cos(60)^0$
So result would be $\cos(60)^0$ that is $\frac{1}{2}$

13. $f(-2) = 2(-2)^2 + 6(-2) - 3$
$f(-2) = -7$

14. $D = 4^2 - 4 \times 1 \times 4 = 0$. So equation has only one root.

15. 8

16. $x^2 - 7x + 2x - 14 = 0$
$(x - 7)(x + 2) = 0$
$x = 7, -2$

17. $\cos\alpha = -\sqrt{1 - \sin^2\alpha} = -\frac{12}{13}$
$\tan\alpha = \frac{-5}{12}$
$\cot\alpha = \frac{-12}{5}$

18. $\frac{2\sin 15^0 \cos 15^0}{2} = \frac{\sin 30^0}{2} = \frac{1}{4}$

19. $h(t) = 10\sin(2\pi \times 0.25) + 5 = 15$

20. $b^2 - 4ac = (1)^2 - 4(1)(12) = -47$
So roots are complex.