BYJU'S Home Learning Program

Topic covered:

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

Worksheet

1. For a given expression $2x^2 + 5x - 9 = 0$. Find the product of the roots.

2. For the expression $2x^2 - 7x - 5$, the roots are α and β, then the value of α+β is
   a. 3.5 b. 2.5
   c. 1.5 d. 4.5

3. For the expression $x^2 - 10x - 13$, the roots are α and β, then the value of α-β is

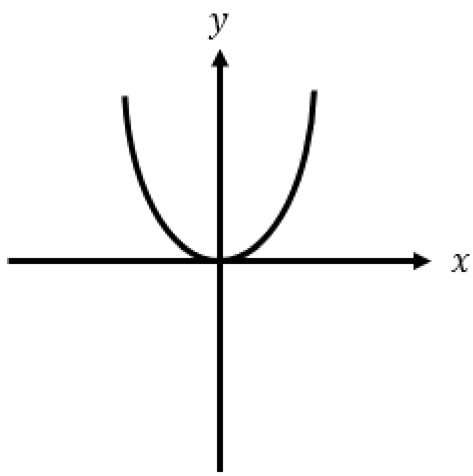
4. A straight line makes an angle 60° with the x- axis then its slope is
   a. 1 b. $\sqrt{3}$ c. $\frac{\sqrt{3}}{2}$ d. -1

5. Find the slope of the line passing through the points (-3, 8) and (1, 4).
   a. – 1 b. 1 c. -3 d. 3

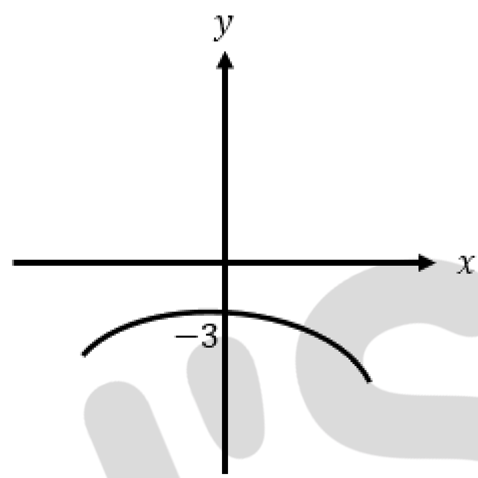
6. Find the nature of the graph of the following quadratic equation in terms of which side it will open.
   (i) $y = x^2 - 8x$ (ii) $y = -2x^2 + 3$ (iii) $y = x^2 - 6x + 4$

7. If $y = x^2 + 2x - 3$, $y - x$ graph is

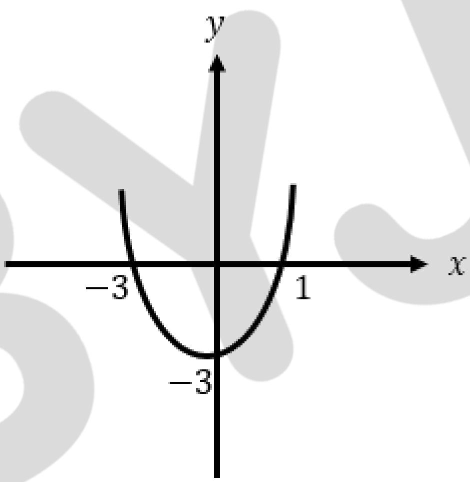
a.



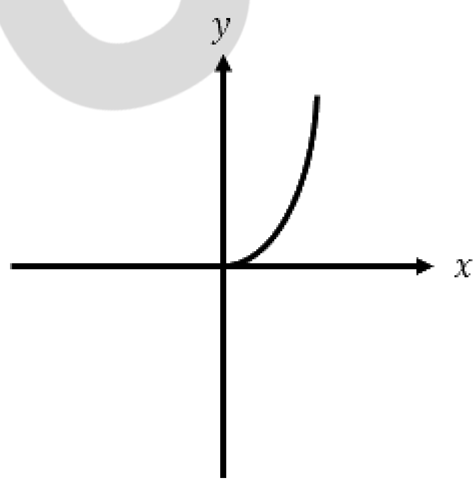
b.



c.



d.



8. Determine the angle (in radians) subtended at the center of a circle of radius 3 cm by each of the following arcs:
   - i. Arc of length 6 cm
   - ii. Arc of length 3π cm
   - iii. Arc of length 1.5 cm
   - iv. Arc of length 6π cm

9. The roots of the equation $x^2 - 18x + 45 = 0$ are
   a. -3, 15
   b. -3, -15
   c. 3, -15
   d. 3, 15

10. Convert angles in radians
    i. 45° ii. 120° iii. 15° iv. 30° v. 270°

11. Convert radians to degrees
    i. $\frac{\pi}{6}$ ii. 5π iii. $\frac{4\pi}{5}$ iv. $\frac{7\pi}{4}$ v. $\frac{\pi}{10}$

12. Find the value of base if in a triangle $\sin\theta = \frac{1}{2}$.
    a. $\sqrt{2}$ b. $\sqrt{3}$ c. $\sqrt{5}$ d. $\sqrt{8}$

13. If $\sin\theta = \frac{3}{5}$, find the value of $cos\ \theta$ and $tan\ \theta$.

14. Find the value of tan θ sin θ + cos θ
    a.1 b. cosecθ c. sin θ d. 0

15. (1 - $\cos^2$ θ) cosec^2θ is equal to
    a.1 b. cosecθ c. sin θ d. 0

16. Find the values of
    i. $\cos(-60^o)$
    ii. $\tan(150^o)$
    iii. sin (240°)

17. Value of sin 15°.cos 15° is:
    a. 1 b. $\frac{1}{2}$ c. $\frac{1}{4}$ d. $\frac{\sqrt{3}}{2}$

18. Value of sin 37°.cos 53° is:
    a. $\frac{9}{25}$ b. $\frac{12}{25}$ c. $\frac{16}{25}$ d. $\frac{3}{5}$

19. If sum of angle A and B is 45° & tan A + tan B = 1. Find the value of $(\tan A)^2 + (\tan B)^2$

20. If $a + b + c = 6$ and $ab + bc + ca = 16$, find the value of $a^2 + b^2 + c^2$

Answer Key

Question Number	1	2	3	4	5
Answer Key	-4.5	(a)	$\sqrt{152}$	(b)	(a)

Question Number	6	7	8	9	10
Answer Key	Upward, downward, upward	(c)	$(2, \pi, 0.5, 2\pi)$	(d)	$\left(\frac{\pi}{4}, \frac{2\pi}{3}, \frac{\pi}{12}, \frac{\pi}{6}, \frac{3\pi}{2}\right)$

Question Number	11	12	13	14	15
Answer Key	$\left(\begin{array}{c}30°, 900°, \\ 144°, 315°, 18°\end{array}\right)$	$\sqrt{3}$	$\cos\theta = \frac{4}{5}$ $\tan\theta = \frac{3}{4}$	$sec\theta$	1

Question Number	16	17	18	19	20
Answer Key	$\left(\frac{1}{2}, -\frac{1}{\sqrt{3}}, -\frac{\sqrt{3}}{2}\right)$	(c)	(a)	1	4

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Solutions

1. For the given equation $a = 2, b = 5, c = -9$
   Product of the roots$= \frac{c}{a} = \frac{-9}{2} = -4.5$

2. (a)
   In the given equation $a = 2, b = -7$ and $c = -5$
   $$\alpha + \beta = -\frac{b}{a} = -\frac{(-7)}{2} = 3.5$$

3. $a = 1, b = -10, c = -13$
   $\alpha - \beta = \frac{\sqrt{b^2-4ac}}{a} = \frac{\sqrt{100+52}}{1} = \sqrt{152}$

4. (b)
   $\mathrm{m} = \tan\theta = \tan 60^0 = \sqrt{3}$

5. (a)
   Slope $= \frac{y_2-y_1}{x_2-x_1} = \frac{4-8}{1+3} = -1$

6. Comparing with standard quadratic equation $y = ax^2 + bx + c$, we get $a = 1, b = -8, c = 0$.
   Since the leading coefficient $a = 1 > 0$, hence the graph will open upwards.

   Comparing with standard quadratic equation $y = ax^2 + bx + c$, we get $a = -2, b = 0, c = 3$. Since the leading coefficient $a = -2 < 0$, hence the graph will open downwards.
   Comparing with standard quadratic equation $y = ax^2 + bx + c$,we get $a = 1, b = -6, c = 4$
   Since the leading coefficient $a = 1 > 0$, hence the graph will open upward.

7. (c)
   y will be zero when, $x^2 + 2x - 3 = 0$
   $\Rightarrow x^2 + 3x - x - 3 = 0$
   $\Rightarrow (x + 3)(x - 1) = 0$
   $\Rightarrow x = -3$ or $x = 1$
   Clearly we can see that option c matches our finding, hence option (c) is the right answer.

8.

i. $S = R\theta \rightarrow \theta = \frac{S}{R} = \frac{6}{3} = 2$

ii. $\theta = \frac{S}{R} = \frac{3\pi}{3} = \pi$

iii. $\theta = \frac{S}{R} = \frac{1.5}{3} = 0.5$

iv. $\theta = \frac{S}{R} = \frac{6\pi}{3} = 2\pi$

9. (d)

$x^2 - 18x + 45 = 0$

$x(x - 15) - 3(x - 15) = 0$

$x = 3, 15$

10.

i. $45° = 45 \times \frac{\pi}{180} = \frac{\pi}{4}$ rad

ii. $120° = 120 \times \frac{\pi}{180} = \frac{2\pi}{3}$ rad

iii. $15° = 15 \times \frac{\pi}{180} = \frac{\pi}{12}$ rad

iv. $30° = 30 \times \frac{\pi}{180} = \frac{\pi}{6}$ rad

v. $270° = 270 \times \frac{\pi}{180} = \frac{3\pi}{2}$ rad

11.

i. $\frac{\pi}{6} =. \frac{\pi}{6} \times \frac{180}{\pi} = 30°$

ii. $5\pi = 5\pi \times \frac{180}{\pi} = 900°$

iii. $\frac{4\pi}{5} = \frac{4\pi}{5} \times \frac{180}{\pi} = 144°$

iv. $\frac{7\pi}{4} = \frac{7\pi}{4} \times \frac{180}{\pi} = 315°$

v. $\frac{\pi}{10} = \frac{\pi}{10} \times \frac{180}{\pi} = 18°$

12. (b)

$\sin\theta = \frac{1}{2}$

$1^2 + x^2 = 22 \implies x = \sqrt{3}$

13. $\sin\theta = \frac{3}{5} \implies$ Hypotenuse = 5, Opposite side = 3 $\implies$ adjacent side = 4

Therefore, $\cos\theta = \frac{4}{5}$ and $\tan\theta = \frac{3}{4}$

14. $\tan\theta \sin\theta + \cos\theta = (\sin\theta/\cos\theta)\cdot\sin\theta + \cos\theta$

$= (\sin^2\theta/\cos\theta) + \cos\theta = (\sin^2\theta + \cos^2\theta) / \cos\theta$

$= 1 / \cos\theta = \sec\theta$

15. (a)

Because $\sin^2\theta + \cos^2\theta = 1$, we have $\sin^2\theta = 1 - \cos^2\theta$

$(1 - \cos^2\theta)\,\mathrm{cosec}^2\theta = \sin^2\theta \cdot \mathrm{cosec}^2\theta = \sin^2\theta \cdot (1/\sin^2\theta)$

$= \sin^2\theta / \sin^2\theta = 1$

16.

i. $\cos -60 = \cos 60 = \frac{1}{2}$

ii. $\tan 150° = \tan(180 + 30) = -\tan 30 = -\frac{1}{\sqrt{3}}$

iii. $\sin 240° = \sin(270 - 30) = -\cos 30 = -\frac{\sqrt{3}}{2}$

17. (c)

$\sin 15°.\cos 15° = \frac{\sin 2(15)}{2} = \frac{\sin 30}{2} = \frac{1}{4}$

18. (a)

$\sin 37°.\cos 53° = \sin 37.\cos(90-37) = \sin^2 37 = \frac{9}{25}$

19.

Given A + B = 45° and tan A + tan B = 1

Using the formula, $(a+b)^2 = a^2 + b^2 + 2ab$

$$(\tan A + \tan B)^2 = (\tan A)^2 + (\tan B)^2 + 2\tan A \tan B$$

We know,

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

Since A + B = 45° $\Rightarrow \tan(A+B) = tan45° = 1$

Also tan A + tan B = 1

Therefore $1 = \frac{1}{1 - tanA\ tanB}$

$$\Rightarrow tanA\ tanB = 0$$

Therefore $(\tan A + \tan B)^2 = (\tan A)^2 + (\tan B)^2 + 2\tan A \tan B$

$$(1)^2 = (\tan A)^2 + (\tan B)^2 + 0$$

$$\Rightarrow (\tan A)^2 + (\tan B)^2 = 1$$

20.

Given $a + b + c = 6$ and $ab + bc + ca = 16$

Using the formula,

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$$
$$= a^2 + b^2 + c^2 + 2(16)$$
$$= a^2 + b^2 + c^2 + 32$$
$$\Rightarrow a^2 + b^2 + c^2 = 36 - 32 = 4$$