

REG-MAE-2324-ASM-SET 1-MATH**Suggested solutions****Multiple Choice Questions**

1. C	2. B	3. B	4. C	5. C
6. A	7. C	8. A	9. B	10. B
11. C	12. C	13. B	14. B	15. A
16. D	17. A	18. B	19. C	20. B
21. B	22. C	23. A	24. C	25. C
26. A	27. C	28. C	29. B	30. C

1. C

$$bpx^2 + (bq + 1)x + (br + c) = 0$$

$$b(px^2 + qx + r) + x + c = 0$$

The roots are the x -coordinates of the intersection of $x + by + c = 0$ and $y = px^2 + qx + r$.

The roots are x_2 and x_5 .

2. B

$P(a, 0)$, $Q(b, 0)$ and $R(0, c)$.

$$c = (0 - a)(0 - b)$$

$$ab = c$$

Required solution are $(a, 0)$ and $(0, ab)$.

3. B

Put $x = -1$ and $x = 2$ into $y - 2x - 3 = 0$, we have $y = 1$ and $y = 7$ respectively.

$$\begin{cases} 1 = 5(-1)^2 + a(-1) + b \\ 7 = 5(2)^2 + a(2) + b \end{cases}$$

Solving, we have $a = -3$ and $b = -7$.

4. C

For the point $(0, 5)$,

$$0 - 2(5) + r = 0 \quad \text{and} \quad 5 = -2(0)^2 + p(0) + q$$

$$r = 10 \quad q = 5$$

At point P , when $x = -2$,

$$(-2) - 2y + 10 = 0 \quad \text{and} \quad 4 = -2(-2)^2 + p(-2) + 5$$

$$y = 4 \quad p = -3.5$$

5. C

$$3x + 8 = (x + 1)^2 + 5$$

$$0 = x^2 - x - 2$$

$$x = 2 \quad \text{or} \quad -1$$

We have $(x, y) = (2, 14)$ or $(-1, 5)$.

Thus, $y = 5$ or 14 .

6. A

$$-9x - 7 = x^2 + 6x + 7$$

$$0 = x^2 + 15x + 14$$

$$x = -1 \quad \text{or} \quad -14$$

When $x = -1$, $y = -9(-1) - 7 = 2$; when $x = -14$, $y = -9(-14) - 7 = 119$.

7. C

$$-4x - 1 = 2x^2 - x - 3$$

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

$$x = -2 \quad \text{or} \quad \frac{1}{2}$$

When $x = -2$, $y = -4(-2) - 1 = 7$; when $x = \frac{1}{2}$, $y = -4\left(\frac{1}{2}\right) - 1 = -3$.

$(x, y) = \left(\frac{1}{2}, -3\right)$ or $(-2, 7)$

8. A

$$x^2 + 4x = -6x - 25$$

$$x^2 + 10x + 25 = 0$$

$$x = -5$$

9. B

$$3x^2 - x(7x - 16) = 12$$

$$-4x^2 + 16x - 12 = 0$$

$$x = 1 \quad \text{or} \quad 3$$

When $x = 1$, $y = 7(1) - 16 = -9$; when $x = 3$, $y = 7(3) - 16 = 5$.

10. B

Rewrite the equations for easier checking: $\begin{cases} (y-x)(y+x) = 20 \\ x-3y = -14 \end{cases}$.

Check if the integral coordinates can satisfy the equation:

$$(y-x)(y+x) = 20 \quad x-3y = -14$$

- | | | |
|------------|---|---|
| A. (7, 7) | ✗ | |
| B. (4, 6) | ✓ | ✓ |
| C. (-4, 6) | ✓ | ✗ |
| D. (6, -4) | ✓ | ✗ |

11. C

$$5(-2) + 4(-1) + k = 0$$

$$k = 14$$

$$5x + 4y + 14 = 0 \longrightarrow y = -\frac{7}{2} - \frac{5x}{4}.$$

$$2x^2 - 2\left(-\frac{7}{2} - \frac{5x}{4}\right)^2 + 4 = 5x\left(-\frac{7}{2} - \frac{5x}{4}\right)$$

$$\frac{41}{8}x^2 - \frac{41}{2} = 0$$

$$x = \pm 2$$

Only option C has the root with $x = 2$.

12. C

$$x - \frac{y}{2} = 2 \longrightarrow y = 2x - 4$$

$$5x^2 + 9x - (2x - 4) = 2$$

$$5x^2 + 7x + 2 = 0$$

$$x = -\frac{2}{5} \quad \text{or} \quad -1$$

13. B

$$3\left(\frac{4}{3}x + 1\right) = 6x^2 + x - 15$$

$$0 = 6x^2 - 3x - 18$$

$$x = 2 \quad \text{or} \quad -\frac{3}{2}$$

$$\text{When } x = -\frac{3}{2}, y = \frac{4}{3}\left(-\frac{3}{2}\right) + 1 = -1; \text{ when } x = 2, y = \frac{4}{3}(2) + 1 = \frac{11}{3}.$$

14. B

$$5 = (-1)^2 - b(-1) + 1$$

$$b = 3$$

$$5 = a(-1) + 3$$

$$a = -2$$

15. A

$$p = 7^2 - 3(7) - 5$$

$$p = 23$$

$$23 = 3(7) + q$$

$$q = 2$$

$$\text{We have } \begin{cases} y = 3x + 2 \\ y = x^2 - 3x - 5 \end{cases}.$$

$$3x + 2 = x^2 - 3x - 5$$

$$0 = x^2 + 6x - 7$$

$$x = 7 \quad \text{or} \quad -1$$

When $x = -1$, $y = 3(-1) + 2 = -1$.

The other solution is $(-1, -1)$.

16. D

Put $x = 3y - 1$ into the first equation,

$$(3y - 1)^2 - y(3y - 1) - 3y^2 = 3$$

$$(9 - 3 - 3)y^2 + (-6 + 1)y + (1 - 3) = 0$$

$$y = 2 \quad \text{or} \quad -\frac{1}{3}$$

Only option D satisfies this.

17. A

We have

$$\begin{cases} 7(2) = a(6) + b \\ 6 = (2)^2 + a(2) + b \end{cases}$$

Solving, we have $a = 3$ and $b = -4$.

18. B

$$-3x^2 + 8x - 1 = 5x - k$$

$$-3x^2 + 3x + k - 1 = 0$$

$$\Delta = 3^2 - 4(-3)(k - 1) \geq 0$$

$$k \geq \frac{1}{4}$$

19. C

$$2x - 3 = x^2 - 4x + (k + 2)$$

$$0 = x^2 - 6x + (k + 5)$$

$$\Delta = 6^2 - 4(1)(k + 5) < 0$$

$$-4k + 16 < 0$$

$$k > 4$$

20. B

$$x - k = x^2 - 7x + 2$$

$$0 = x^2 - 8x + 2 + k$$

$$\Delta = 8^2 - 4(1)(2 + k) = 0$$

$$-4k + 56 = 0$$

$$k = 14$$

21. B

$$x^2 + (2x + 5)^2 = k$$

$$5x^2 + 20x + 25 - k = 0$$

$$\Delta = 20^2 - 4(5)(25 - k) \geq 0$$

$$20k - 100 \geq 0$$

$$k \geq 5$$

22. C

$$kx^2 - (x + 1)^2 + x(x + 1) = 1$$

$$kx^2 - x - 2 = 0$$

$$\Delta = 1^2 - 4(k)(-2) < 0$$

$$8k + 1 < 0$$

$$k < -\frac{1}{8}$$

23. A

$$5 - x = 4x^2 - 5x + 2$$

$$0 = 4x^2 - 4x - 3$$

$$x = \frac{3}{2} \quad \text{or} \quad -\frac{1}{2}$$

Since x -coordinate of A is negative, required x -coordinate is $-\frac{1}{2}$.

24. C

$$3x - 14 = 2x^2 - 9x + c$$

$$0 = 2x^2 - 12x + (c + 14)$$

$$\Delta = 12^2 - 4(2)(c + 14) = 0$$

$$c = 4$$

25. C

$$\frac{10x - k}{2} = 6x^2 - 7x - 5$$

$$0 = 6x^2 - 12x + \frac{k}{2} - 5$$

$$\Delta = 12^2 - 4(6)\left(\frac{k}{2} - 5\right) < 0$$

$$k > 22$$

26. A

$$x^2 = x + 2$$

$$x^2 - x - 2 = 0$$

$$x = 2 \quad \text{or} \quad -1$$

We have $(x, y) = (2, 4)$ or $(-1, 1)$.

Denote the intersection of AB and the y -axis by C .

The coordinates of C are $(0, 2)$.

$$\begin{aligned} \text{Required area} &= \frac{(OC)(1)}{2} + \frac{(OC)(2)}{2} \\ &= 3 \end{aligned}$$

27. C

$$x^2 - 5k + k = 3x - 2$$

$$x^2 - 8x + (k + 2) = 0$$

$$\Delta = 8^2 - 4(1)(k + 2) = 0$$

$$-4k + 56 = 0$$

$$k = 14$$

28. C

The coordinates of F are $(2, 0)$.

$$x^2 - 2x - 3 = \frac{3}{2}x - 3$$

$$x^2 - 3.5x = 0$$

$$x = 0 \quad \text{or} \quad 3.5$$

The coordinates of D and E are $(0, -3)$ and $(3.5, 2.25)$.

$$\begin{aligned} \text{Required area} &= \frac{(BF)(3)}{2} + \frac{(BF)(2.25)}{2} \\ &= \frac{21}{8} \end{aligned}$$

29. B

$$2x + 1 = x^2 - 6x + k$$

$$0 = x^2 - 8x + (k - 1)$$

$$\alpha + \beta = -\frac{-8}{1}$$

$$= 8$$

30. C

$$3x + 5 = -x^2 + bx + c$$

$$0 = -x^2 + (b - 3)x + (c - 5)$$

$$x\text{-coordinate of } M = \frac{1}{2} \left[-\frac{b-3}{-1} \right]$$

$$= \frac{b-3}{2}$$

$$y\text{-coordinate of } M = 3 \left(\frac{b-3}{2} \right) + 5$$

$$= \frac{19-3b}{2}$$

$$\text{The coordinates of } M \text{ are } \left(\frac{b-3}{2}, \frac{19-3b}{2} \right).$$