REG-QE-2223-ASM-SET 1-MATH
Suggested solutions

Multiple Choice Questions

1. A

β is a root.

$$4\beta^2 - 5\beta - 1 = 0$$
$$4\beta^2 - 5\beta = 1$$
$$\begin{aligned} 7 + 10\beta - 8\beta^2 &= 7 - 2(4\beta^2 - 5\beta) \\ &= 7 - 2(1) \\ &= 5 \end{aligned}$$

2. B

$$6\alpha^2 - 8\alpha + 17 = 0$$
$$2(4\alpha - 3\alpha^2) = 17$$
$$\begin{aligned} 5 + 4\alpha - 3\alpha^2 &= 5 + \frac{17}{2} \\ &= \frac{27}{2} \end{aligned}$$

3. D

We have $3\alpha^2 - 4\alpha - 2 = 0$.

$$\begin{aligned} 9 + 12\alpha - 9\alpha^2 &= 9 - 3(3\alpha^2 - 4\alpha) \\ &= 9 - 3(0 + 2) \\ &= 3 \end{aligned}$$

4. D

$$3x - 2x^2 - 1 = 0$$
$$-2x^2 + 3x - 1 = 0$$
$$x = \frac{1}{2} \quad \text{or} \quad 1$$

5. C

$$(x - a)^2 = 9a^2$$
$$x - a = 3a \quad \text{or} \quad x - a = -3a$$
$$x = 4a \quad \text{or} \quad x = -2a$$

6. B

$(x-b)^2 = a^2 - 2ab + b^2$

$(x-b)^2 = (a-b)^2$

$x - b = \pm(a-b)$

$x = a \quad \text{or} \quad -a + 2b$

7. D

$x(x-6) = x$

$x - 6 = 1 \quad \text{or} \quad x = 0$

$x = 7 \quad \text{or} \quad x = 0$

8. D

$(x-2)(x-4) = x - 4$

$x - 2 = 1 \quad \text{or} \quad x - 4 = 0$

$x = 3 \quad \text{or} \quad x = 4$

9. C

$x + 2 = 0 \quad \text{or} \quad 5x - 2 = 2$

$x = -2 \quad \text{or} \quad x = \frac{4}{5}$

10. D

The equation holds for $x = k$.

When $x = k - 1$,

$$(x-1)(x-2) = (k-2)(k-3)$$
$$\neq (k-1)(k-2)$$

When $x = 3 - k$,

$$(x-1)(x-2) = (2-k)(1-k)$$
$$= (k-1)(k-2)$$

Thus, $x = k$ or $3 - k$.

11. E

$x = a$ is a root of the equation (obvious).

When $x = 2$ or 3, L.H.S. $= 0 \neq$ R.H.S.

Options C and D are wrong.

When $x = 5 - a$, L.H.S. $= (5-a-2)(5-a-3) = (3-a)(2-a) = (a-2)(a-3) =$ R.H.S.

Thus, $x = a$ or $5 - a$.

12. C

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

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

$x=\dfrac{k}{2}$ or 0

13. D

$x-a=(x-a)(x-b)$

$x=a$ or $1=x-b$

$x=a$ or $x=b+1$

14. D

$(x+1)(x-3)=1$

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

$x=\dfrac{2\pm\sqrt{2^2-4(-4)}}{2(1)}$

$=1\pm\sqrt{5}$

15. B

Roots of equation $x^2+bx+c=0$ are the x-intercepts of the graph.

16. B

We have $b=10$.

$0=-(-5)^2+a(-5)+10$

$a=-3$

17. C

We have $c=-1$.

$k=2(1)^2-4(1)-1$

$k=-3$

18. D

The coordinates of G are $(0,\ c)$.

$$c = ax^2 - x + c$$
$$0 = x(ax - 1)$$
$$x = 0 \quad \text{or} \quad \frac{1}{a}$$

The coordinates of E and F are $\left(\frac{1}{a},\ 0\right)$ and $\left(\frac{1}{a},\ c\right)$ respectively.

$$\text{Required area} = \left(\frac{1}{a}\right)(-c)$$
$$= -\frac{c}{a}$$

19. C

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

$$0 = 3x^2 - 7x + 2$$
$$x = \frac{1}{3} \quad \text{or} \quad 2$$

The coordinates of A and B are $\left(\frac{1}{3},\ 0\right)$ and $(2,\ 0)$ respectively.

$$\text{Required area} = \frac{\left(2 - \frac{1}{3}\right)(2)}{2}$$
$$= \frac{5}{3}$$

20. C

$C\ (0,\ 4)$.

$0 = 2x^2 - 9x + 4$

$x = \frac{1}{2} \quad \text{or} \quad 4$

$A\left(\frac{1}{2},\ 0\right)$ and $B\ (4,\ 0)$.

$\text{Required area} = \frac{\left(4 - \frac{1}{2}\right)(4)}{2} = 7.$

21. C

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

$k < \frac{4}{3}$

22. C

$\Delta = k^2 - 4(4)(9) = 0$

$k = \pm 12$

When $k = 12$,

$4x^2 + 12x + 9 = 0$

$x = -\frac{3}{2}$ (not a positive root)

When $k = -12$,

$4x^2 - 12x + 9 = 0$

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

Thus, $k = -12$.

23. D

$\Delta = b^2 - 4(4b) = 0$

$b = 0$ or 16

24. D

$x^2 + 6x + (k - 3) = 0.$

$\Delta = 6^2 - 4(k - 3) < 0$

$k > 12$

25. C

$\Delta = 6^2 - 4k(6 - k) = 0$

$4k^2 - 24k + 36 = 0$

$k = 3$

26. B

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

$k \leq 2$

27. C

$\Delta = k^2 - 4(8k + 36) = 0$

$k^2 - 32k - 144 = 0$

$k = -4$ or 36

28. B

$x^2 + ax + (a - 1) = 0.$

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

29. B

$$4x^2 + 3x + 1 = kx$$
$$4x^2 + (3 - k)x + 1 = 0$$
$$\Delta = (3 - k)^2 - 4(4)(1) = 0$$
$$k^2 - 6k - 7 = 0$$
$$k = 7 \quad \text{or} \quad -1$$

30. E

$0 = x^2 - 6x + k.$

$$\Delta = 6^2 - 4k = 0$$
$$k = 9$$

Conventional Questions

31. (a) $(-k-2)(-3k+k) = -k+k$ 1M

$(-k-2)(-2k) = 0$

$k = 0 \quad \text{or} \quad -2$ 1A

(b) $k = -2$.

$(x-2)(3x-2) = x-2$ 1M

$(x-2)(3x-3) = 0$ 1M

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

The other root is 1. 1A

32. (a) $-36 = 3(1-k)(1+1)^2$ 1M

$k = 4$ 1A

(b) $0 = 3(x-4)(x+1)^2$ 1M

$x = 4 \quad \text{or} \quad -1$

The x-intercepts are 4 and -1. 1A

33. (a) The coordinates of C are $(0,\ 7)$. 1A

$7 = -\frac{1}{3}(x+3)(x-7)$ 1M

$0 = x^2 - 4x$

$x = 0 \quad \text{or} \quad 4$

The coordinates of D are $(4,\ 7)$. 1A

(b) Required area $= \frac{1}{2} \times 4 \times 7$ 1M

$= 14$ 1A

34. $(-6)^2 - 4(1)(k) \geq 0$ 1M

$36 - 4k \geq 0$

$k \leq 9$ 1A

There are 9 possible values of k. 1A

35. (a) Discriminant $= [2(k-4)]^2 - 4(2)(k)$ 1M

$= 4k^2 - 40k + 64$ 1A

(b) $\Delta = 4k^2 - 40k + 64 = 0$ 1M

$k = 2 \quad \text{or} \quad 8$ 1A

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