REG-EOC-2324-ASM-SET 2-MATH
Suggested solutions

Multiple Choice Questions

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

1. $\boxed{\text{C}}$

The coordinates of centre are $(-3,\ -6)$.
Radius $= \sqrt{9} = 3$

2. $\boxed{\text{D}}$

The coordinates of the centre are $(2,\ -1)$.
Circumference $= 2\pi(\sqrt{2^2 + 1^2 + 11})$
$= 8\pi$

3. $\boxed{\text{C}}$

$\frac{k}{-2} = 2$
$k = -4$
Area $= \pi(\sqrt{1^2 + 2^2 + 11})^2$
$= 16\pi$

4. $\boxed{\text{A}}$

The coordinates of the centre are $(-1,\ 5)$.
$-1 - 3(5) + 2a = 0$
$a = 8$

5. $\boxed{\text{C}}$

The coordinates of the centre are $(-1,\ 6)$.

A. ✗. $2(-1) + 6 - 3 = 1 \neq 0$
B. ✗. $-1 + 3(6) - 14 = 3 \neq 0$
C. ✓. $2(-1) + 3(6) - 16 = 0$
D. ✗. $2(-1) + 2(6) - 7 = 3 \neq 0$

6. A

The coordinates of the centre are $\left(-\frac{D}{2},\ 5\right)$.
Centre lies on the straight line $5x - 6y + 25 = 0$.

$$5\left(-\frac{D}{2}\right) - 6(5) + 25 = 0$$
$$D = -2$$

7. D

The coordinates of the centre are $(3,\ -4)$.
Radius $= \sqrt{3^2 + 4^2 - 9} = 4$

I. ✓.

II. ✓. Distance from centre to the x-axis is equal to the radius.

III. ✓. Distance from centre to the y-axis is smaller than the radius.

8. A

$x^2 + 0 - 11x + 0 + 18 =$ and $0 + y^2 - 0 + 9y + 18 = 0$

$x = 2$ or 9 $y = -3$ or -6

Required area $= \frac{(9)(6)}{2} - \frac{(2)(3)}{2}$
$= 24$

9. B

A. ✗. Rewrite the equation as $(x-2)^2 + (y+3)^2 = -10$. We have $r^2 = -10 < 0$, which is impossible.

B. ✓.

C. ✗. The coefficients of x^2 and y^2 are different.

D. ✗. The coefficients of x^2 and y^2 are different.

10. C

The coordinates of centre are $(4,\ -2)$.

$$4^2 + 2^2 + 4k > 0$$
$$k > -5$$

11. B

A. ✗. $h^2 + k^2 - F = 3^2 + 5^2 - 30 = 4 \neq 0$

B. ✓. $h^2 + k^2 - F = 4^2 + 1^2 - 17 = 0$

C. ✗. $h^2 + k^2 - F = 2.5^2 + 2.5^2 + 3.5 = 16 \neq 0$

D. ✗. $h^2 + k^2 - F = 6^2 + 2^2 - 70 = -30 \neq 0$

12. D

The circle $x^2 + y^2 - 2(k + 1)x - 2(k - 3)y - 2(k^2 - 9) = 0$ is a real circle.

$$(k + 1)^2 + (k - 3)^2 + 2(k^2 - 9) > 0$$
$$4k^2 - 4k - 8 > 0$$
$$k < -1 \quad \text{or} \quad k > 2$$

13. A

The coordinates of the centre are $(-1,\ 6)$.

$$10 = 2\sqrt{1^2 + 6^2 - k}$$
$$k = 12$$

A. ✓. L.H.S. $= 0^2 + 0^2 + 0 - 0 + 12 = 12 > 0$
The point $(0,\ 0)$ lies outside the circle C.

B. ✗. L.H.S. $= 2^2 + 5^2 + 2(2) - 12(5) + 12 = -15 < 0$
The point $(2,\ 5)$ lies inside the circle C.

C. ✗. L.H.S. $= 1^2 + 6^2 + 2(1) - 12(-6) + 12 = 123 > 0$
The point $(1,\ -6)$ lies outside the circle C.

D. ✗. L.H.S. $= 2^2 + 2^2 + 2(-2) - 12(-2) + 12 = 40 > 0$
The point $(-2,\ -2)$ lies inside the circle C.

14. B

A. L.H.S. $= 0 + 6^2 - 0 - 10(6) - 35 = -59$
$A\ (0,\ 6)$ lies inside the circle.

B. L.H.S. $= 6^2 + 6^2 - 4(-6) - 10(6) - 35 = 1 > 0$
$B\ (-6,\ 6)$ lies outside the circle.

C. L.H.S. $= 4^2 + 2^2 - 4(4) - 10(-2) - 35 = -11 < 0$
$C\ (4,\ -2)$ lies inside the circle.

D. L.H.S. $= 1^2 + 2^2 - 4(-1) - 10(-2) - 35 = -6 < 0$
$D\ (-1,\ -2)$ lies inside the circle.

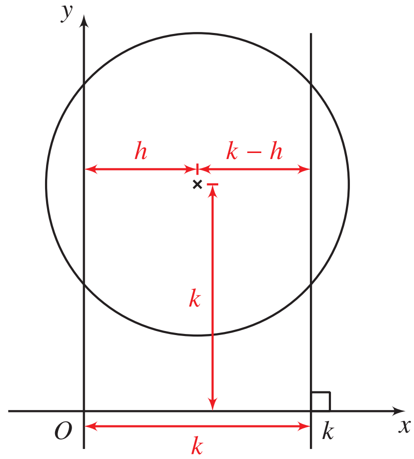
15. B

The centre lies in the first quadrant. Therefore, $h > 0$ and $k > 0$.

I. ✓. We have $h < r$, and therefore $h - r < 0$.

II. ✗. We have $k > r$, and therefore $k - r > 0$.

III. ✓. We have $k - h < r$.



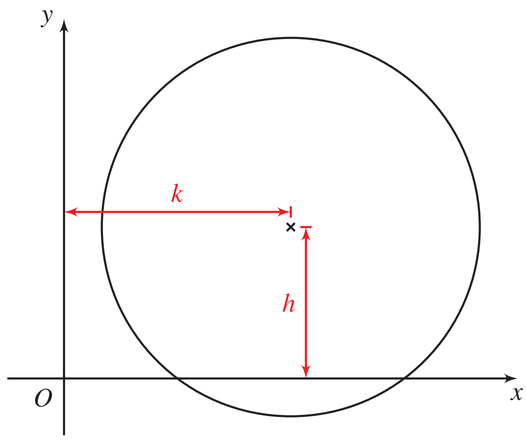
16. A

The centre lies in the first quadrant. We have $h > 0$ and $k > 0$.

I. ✓. We have $h < k$, and therefore $h - k < 0$.

II. ✓. We have $h < r$, and therefore $h - r < 0$.

III. ✗. We have $k > r$, and therefore $k - r > 0$.



17. A

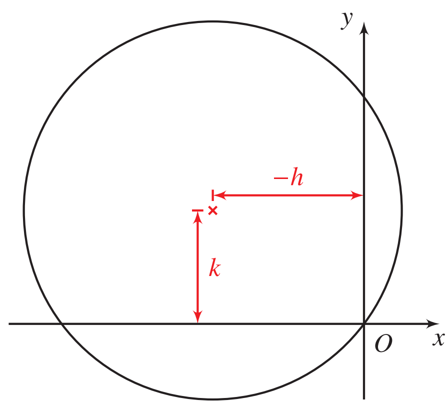
The centre lies in quadrant II. We have $h < 0$ and $k > 0$.

I. ✓.

II. ✓. We have $r > -h$, and therefore $r + h > 0$.

III. ✗. Consider the distance between centre and the origin.

$$r > \sqrt{h^2 + k^2}$$
$$r^2 > h^2 + k^2$$



18. B

The coordinates of centre of C_1 are $(3,\ 4)$.
Radius of $C_1 = \sqrt{3^2 + 4^2 + 9} = \sqrt{34}$
The coordinates of centre of C_2 are $(6,\ 6)$.
Radius of $C_2 = \sqrt{6^2 + 6^2 - 67} = \sqrt{5}$
Distance between centres $= \sqrt{(6-3)^2 + (6-4)^2} = \sqrt{13}$
The centre of C_2 lies in circle C_1.
The answer is B.

19. C

The coordinates of the centre are $(3,\ 2)$.
Radius $= \sqrt{3^2 + 2^2 - 4} = 3$
Distance between A and the centre $= \sqrt{(3+3)^2 + (2+6)^2} = 10$
Required distance $= 10 - 3 = 7$

20. C

Centre $(1,\ -2)$; radius $= \sqrt{1^2 + 2^2 - 4} = 1$
Distance from A to centre $= \sqrt{(5-1)^2 + (-5+2)^2} = 5$
Required distance $= 5 - 1$
$= 4$

21. B

I. ✓.
II. ✗. Radius $= \sqrt{3^2 + 6^2 + 4} = 7 \neq 49$
III. ✓. L.H.S. $= 0^2 + 0^2 - 0 + 0 - 4 < 0$
The origin lies inside the circle.

22. C

C: $x^2 + y^2 - 6x + 2y + \frac{3}{2} = 0$
The coordinates of the centre are $(3,\ -1)$.
Radius $= \sqrt{3^2 + 1^2 - \frac{3}{2}} = \sqrt{8.5}$.

I. ✗.
II. ✓. The coordinates of the mid-point of PQ are $(2,\ 2)$.
L.H.S. $= 2^2 + 2^2 - 6(2) + 2(2) + \frac{3}{2} = 1.5 > 0$
The mid-point of PQ lies outside C.
III. ✓. (slope of PG)(slope of QG) $= \frac{1+1}{-1-3} \times \frac{3+1}{5-3}$
$= -1$
Thus, $\angle PGQ = 90°$.

23. C

$x^2 + y^2 + 4x - 6y - 12 = 0$

The coordinates of the centre are $(-2,\ 3)$.

Radius $= \sqrt{2^2 + 3^2 + 12} = 5$

A. ✗.

B. ✓.

C. ✓. L.H.S. $= 0^2 + 0^2 + 0 - 0 - 12 = -12 < 0$

The origin lies inside the circle.

24. A

$x^2 + y^2 + 4x + 8y - 5 = 0$

The coordinates of the centre are $(-2,\ -4)$.

Radius $= \sqrt{2^2 + 4^2 + 5} = 5$

I. ✓.

II. ✗. The coordinates of the mid-point of AB are $(2,\ 0)$.

L.H.S. $= 2^2 + 0 + 4(2) + 0 - 5 = 7 \neq 0$

The mid-point of AB does not lie on the circle.

III. ✗. $(\text{slope of } AG)(\text{slope of } BG) = \dfrac{2+4}{3+2} \times \dfrac{-2+4}{1+2}$

$= \dfrac{4}{5} \neq -1$

AG and BG are not perpendicular to each other.

Conventional Questions

25. (a) Coordinates of centres of C_1 and C_2 are $(5,\ -3)$ and $(2,\ -4)$ respectively. 1M

Required distance $= \sqrt{(5-2)^2 + (-3+4)^2} = \sqrt{10}$ 1A

(b) The radius of C_1 and C_2 are 2 and 3 respectively.

Since $(3-2) <$ distance between two centres $< (3+2)$, 1M

the two circles intersect at two points. 1A

26. (a) Coordinates of centres of C_1 and C_2 are $(2,\ -1)$ and $(-2,\ -3)$ respectively. 1M

Required distance $= \sqrt{(2+2)^2 + (-1+3)^2} = 2\sqrt{5}$ 1A

(b) $\sqrt{2^2 + (-1)^2} + \sqrt{(-2)^2 + (-3)^2 - k} = 2\sqrt{5}$ 1M

$$\sqrt{13-k} = \sqrt{5}$$

$$k = 8$$ 1A

27. (a) The coordinates of M are $(4,\ 7)$. 1A

Radius $= \sqrt{4^2 + 7^2 - 61} = 2$ 1A

(b) Slope of L is $-\dfrac{4}{3}$.

Slope of $MN = \dfrac{3}{4}$ 1M

Required equation is

$$y - 7 = \frac{3}{4}(x-4)$$ 1M

$$3x - 4y + 16 = 0$$ 1A

(c) (i) Solve $\begin{cases} 3x - 4y + 16 = 0 \\ 4x + 3y - 62 = 0 \end{cases}$, 1M

we have $x = 8$ and $y = 10$.

The coordinates of N are $(8,\ 10)$. 1A

(ii) $MN = \sqrt{(8-4)^2 + (10-7)^2} = 5$

Required distance $= 5 - 2$ 1M

$= 3$ 1A

28. (a) $(2,\ 3)$ 1A

(b) (i) Let the coordinates of P be $(a,\ b)$.

We have $3a - 2b - 13 = 0$.

Slope of $PA = \dfrac{3-b}{2-a}$

$\dfrac{3-b}{2-a} \times \dfrac{3}{2} = -1$ 1M

$2a + 3b - 13 = 0$

Solving, we have $a = 5$ and $b = 1$. 1A

Required length $= \sqrt{(5-2)^2 + (1-3)^2}$

$= \sqrt{13}$ 1A

(ii) (1) P, A and Q are collinear. 1A

(2) Radius $= \sqrt{2^2 + 3^2 - 9}$

$= 2$

Required ratio $= AQ : AP$ 1M

$= 2 : \sqrt{13}$ 1A

 END OF PAPER