REG-EOC-2425-ASM-SET 6-MATH
Suggested solutions

Multiple Choice Questions

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

1. B

Solve $\begin{cases} 2x - y = 25 \\ x^2 + y^2 - 52x - 34y + 925 = 0 \end{cases}$, we have $(x,\ y) = (24,\ 23)$ or $(20,\ 15)$.

The coordinates of P and Q are $(24,\ 23)$ and $(20,\ 15)$.

The coordinates of the mid-point of PQ are $(22,\ 19)$.

Required equation is

$$(x - 22)^2 + (y - 19)^2 = (20 - 22)^2 + (15 - 19)^2$$
$$(x - 22)^2 + (y - 19)^2 = 20$$

2. C

Use the calculator program to check the intersections.

A. ✗. Centre of this circle is at $(-3,\ 1)$.

B. ✗. MATH ERROR $\Rightarrow$ no intersections.

C. ✓. Only one intersection $\Rightarrow$ circle touches the line.

D. ✗. MATH ERROR $\Rightarrow$ no intersections.

3. C

Solve the system $\begin{cases} 3x + 4y - k = 0 \\ x^2 + y^2 - 4x - 2y - 20 = 0 \end{cases}$ using the calculator program.

The system has repeated solutions when $k = 35$ or -15.

Thus, $k = 35$ or -15.

4. D

Solve the system $\begin{cases} mx - y - 1 = 0 \\ x^2 + y^2 - 16x - 2y + 31 = 0 \end{cases}$ using the calculator program.

The system has repeated solutions when $m = \frac{5}{3}$ and when $m = -\frac{3}{5}$.

Thus, $m = \frac{5}{3}$ or $-\frac{3}{5}$.

5. B

Solve the system $\begin{cases} x + 2y - 5 = 0 \\ x^2 + y^2 + 2kx - 4y + k^2 - 1 = 0 \end{cases}$ using the calculator program.

The system has repeated solutions when $k = -6$ or 4.

The coordinates of the centre are $(-4,\ 2)$ or $(6,\ 2)$.

6. A

Solve the system $\begin{cases} x + y + k = 0 \\ x^2 + y^2 - 6x - 2y + 8 = 0 \end{cases}$ using the calculator program.

The system has repeated solutions when $k = -2$ or -6.

Thus, $k = -2$ or -6.

7. B

Solve the system $\begin{cases} kx + y = 0 \\ x^2 + y^2 - 2x - y + 1 = 0 \end{cases}$ using the calculator program.

Value of k	Number of intersections	Sign of Δ
$-\frac{4}{3}$	1	
1	0	–

$-\frac{4}{3}$ is a boundary value of the required range.

Required range does not contain 1.

The answer is B.

8. C

Solve the simultaneous equations $\begin{cases} mx - y - 5 = 0 \\ x^2 + y^2 - 11x + 7y + 20 = 0 \end{cases}$ using the calculator program.

Value of m	Number of intersections	Sign of Δ
-3	0	–

Required range contains -3 and -3 is not a boundary value.

The answer is C.

9. A

Solve the system $\begin{cases} x - 2y + k = 0 \\ x^2 + y^2 - 12x - 24y - 320 = 0 \end{cases}$ using the calculator program.

Value of k	Number of intersections	Sign of Δ
-32	1	

-32 is a boundary value of the required range.

The answer is A.

10. C

Solve the system $\begin{cases} 5x + 3y + k = 0 \\ x^2 + y^2 - 6x + 10y = 0 \end{cases}$ using the calculator program.

Value of k	Number of intersections	Sign of Δ
-17	2	+

-17 is not a boundary value of the required range.

Required range contains -17.

The answer is C.

11. D

Solve the system $\begin{cases} x + ky - 3 = 0 \\ x^2 + y^2 - 4x - 6y + 5 = 0 \end{cases}$ using the calculator program.

Value of k	Number of intersection	Sign of Δ
-7	0	–

-7 is not a boundary value of the required range.

Required range contains -7.

The answer is D.

12. D

Solve the system $\begin{cases} x - y + m = 0 \\ x^2 + y^2 + 2x - 4y - 13 = 0 \end{cases}$ using the calculator program.

Value of m	Number of intersections	Sign of Δ
-9	0	–

Required range does not contain $m = -9$ and -9 is not a boundary value of the required range.

The answer is D.

13. A

Solve the system $\begin{cases} kx - y + 2 = 0 \\ x^2 + y^2 - 5x - 9y + 24 = 0 \end{cases}$ using calculator program.

Value of k	Number of intersection	Sign of Δ
$\frac{1}{3}$	1	0
-3	0	–

Required range has $\frac{1}{3}$ as one of the boundary value, and it contains $k = -3$.
The answer is A.

14. D

Solve the system $\begin{cases} kx - y - 3 = 0 \\ x^2 + y^2 + 4x + 8y + 19 = 0 \end{cases}$ using the calculator program.

Value of k	Number of intersection	Sign of Δ
$-\frac{3}{4}$	0	–
$\frac{3}{4}$	2	+

$-\frac{3}{4}$ and $\frac{3}{4}$ are not boundary values of the required range.
Required range contains $-\frac{3}{4}$, while it does not contain $\frac{3}{4}$.
The answer is D.

15. A

Solve the system $\begin{cases} x + y = 0 \\ x^2 + y^2 + 2kx + k^2 - 8 = 0 \end{cases}$ using the calculator program.

Value of k	Number of intersection	Sign of Δ
0	2	+

Required range contains 0.
The answer is A.

16. A

The equation of L is $y = -\dfrac{3x}{4} + k$.

Solve the system $\begin{cases} \dfrac{3x}{4} + y - k = 0 \\ x^2 + y^2 - 8x + 12y - 48 = 0 \end{cases}$ using the calculator program.

Value of k	Number of intersections	Sign of Δ
0	2	+

Required range contains 0.

The answer is A.

17. A

Solve the system $\begin{cases} 2x - y + k = 0 \\ x^2 + y^2 + 4x + ky + 3 = 0 \end{cases}$ using the calculator program.

Value of k	Number of intersection	Sign of Δ
1	1	
0	0	–

1 is a boundary value of the required range.

Required range contains 0.

The answer is A.

18. A

Solve the system $\begin{cases} 2x + y - 5 = 0 \\ x^2 + y^2 - kx + 6y - 10 = 0 \end{cases}$ using the calculator program.

Value of k	Number of intersections	Sign of Δ
2	2	+

Required range does not contain 2 and 2 is not a boundary value of the range.

The answer is A.

19. B

Solve the system $\begin{cases} mx - y - 2 = 0 \\ x^2 + y^2 + 6x + 5 = 0 \end{cases}$ using the calculator program.

Value of m	Number of intersection	Sign of Δ
$\frac{12}{5}$	0	–

$\frac{12}{5}$ is not a boundary value of the required range.

Required range does not contain $\frac{12}{5}$.

The answer is B.

20. D

Solve the system $\begin{cases} 2x + y + k = 0 \\ x^2 + y^2 + 12x - 8y + 32 = 0 \end{cases}$ using the calculator program.

Value of k	Number of intersection	Sign of Δ
-18	0	–

-18 is not a boundary value of the required range.

Required range contains -18.

The answer is D.

Conventional Questions

21. $x^2 + (-2x - k)^2 + 2x + 2(-2x - k) - 3 = 0$ 1M

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

$5x^2 + (4k - 2)x + (k^2 - 2k - 3) = 0$

$\Delta = (4k - 2)^2 - 4(5)(k^2 - 2k - 3) = 0$ 1M

$(16 - 20)k^2 + (-16 + 40)k + (4 + 60) = 0$

$-4k^2 + 24k + 64 = 0$

$k = -2$ or 8 1A+1A

22. $x^2 + (x + 9)^2 + 13x - 15(x + 9) + (4k + 6) = 0$ 1M

$(1 + 1)x^2 + (18 + 13 - 15)x + (81 - 135 + 4k + 6) = 0$

$2x^2 + 16x + (4k - 48) = 0$

$\Delta = 16^2 - 4(2)(4k - 48) = 0$ 1M

$-32k + 640 = 0$

$k = 20$ 1A

23. $x^2 + (3x + 8)^2 - 5x - 4(3x + 8) + k = 0$ 1M

$(1 + 9)x^2 + (48 - 5 - 12)x + (64 - 32 + k) = 0$

$10x^2 + 31x + 32 + k = 0$ 1A

$\Delta = 31^2 - 4(10)(32 + k) < 0$ 1M

$-319 - 40k < 0$

$k > -\frac{319}{40}$

Required value is -7. 1A

24. $0^2 + y^2 + k(0) - 6y + 9 = 0$ 1M

$y^2 - 6y + 9 = 0$

$(y - 3)^2 = 0$

$y = 3$ 1M

The circle intersect the y-axis at only one point.

The circle touches the y-axis. 1

 END OF PAPER