

REG-2425-MOCK-SET 4-MATH-CP 2

Answers:

- | | | | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. D | 2. D | 3. D | 4. C | 5. C | 6. B | 7. A | 8. A | 9. D | 10. B |
| 11. D | 12. A | 13. A | 14. C | 15. D | 16. C | 17. A | 18. A | 19. C | 20. A |
| 21. D | 22. A | 23. B | 24. C | 25. B | 26. B | 27. D | 28. B | 29. C | 30. B |
| 31. A | 32. C | 33. A | 34. D | 35. D | 36. A | 37. B | 38. C | 39. D | 40. B |
| 41. C | 42. B | 43. B | 44. D | 45. C | | | | | |

Suggested Solutions:

1. D

$$\begin{aligned}2^{2n} \cdot 9^n &= 2^{2n} \cdot 3^{2n} \\ &= 6^{2n}\end{aligned}$$

2. D

Check the coefficient of each term.

	$-q$	p	q^2
A.	<input checked="" type="checkbox"/>		
B.	<input checked="" type="checkbox"/>		
C.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
D.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

3. D

$$\begin{aligned}\frac{a+x}{x+b} &= \frac{c}{d} \\ ad + dx &= cx + bc \\ x(d-c) &= bc - ad \\ x &= \frac{ad - bc}{c - d}\end{aligned}$$

4. C

$$\begin{aligned}\frac{1}{2x-5} - \frac{1}{2x+5} &= \frac{(2x+5) - (2x-5)}{(2x-5)(2x+5)} \\ &= \frac{10}{4x^2 - 25}\end{aligned}$$

5. C

$$\text{Solve } \begin{cases} 2u + 3v = -6 \\ 3u - 4v = 25 \end{cases}, \text{ we have } u = 3 \text{ and } v = -4.$$

6. B

The inequalities become $x < 1$ or $x \leq -1$.

Thus, $x < 1$.

7. A

I. \checkmark . You may take m and n be some random numbers to verify it. The detail proof is written below.

$$\begin{aligned} m^3 - n^3 &= (m - n)(m^2 + mn + n^2) \\ &= (m - n) \left[\left(m + \frac{n}{2}\right)^2 + \frac{3n^2}{4} \right] \end{aligned}$$

Since $\left(m + \frac{n}{2}\right)^2 + \frac{3n^2}{4} > 0$ and $m - n > 0$, we have $m^3 - n^3 > 0$ and $m^3 - n^3$.

II. \checkmark . $k^3 < 0$ and therefore $\frac{m}{k^3} < \frac{n}{k^3}$.

III. \times . Take $m = 2, n = k = -1$.

$$m + nk = 2 + 1 = 3 \text{ and } n + mk = -1 - 2 = -3 \text{ but } m + nk < n + mk.$$

8. A

$$\begin{aligned} f(k+2) &= 2(k+2)^2 + 3(k+2) - 2 \\ &= 2k^2 + (8+3)k + (8+6-2) \\ &= 2k^2 + 11k + 12 \end{aligned}$$

9. D

Compare the coefficients of x^2 .

$$A = 2$$

Compare the coefficients of x .

$$-2A + B = -5$$

$$B = -1$$

10. **B**

Let the cost and the discount per cent be \$ x and $r\%$ respectively.

$$x(1 + 10\%)(1 - r\%) = x(1 - 23\%)$$
$$r = 30$$

11. **D**

$$\text{Interest} = 4000 \left(1 + \frac{4\%}{4}\right)^{5 \times 4} - 4000$$
$$\approx \$881$$

12. **A**

Let the scale be $1 : x$.

$$\frac{400 \times 100^2}{4} = x^2$$
$$x = 1000$$

13. **A**

$$(1, -\sqrt{3}) \rightarrow (\sqrt{3}, 1) = (2, 30^\circ)$$

14. **C**

Let $y = \frac{k}{x^2}$, where k is a non-zero constant.

$$\frac{y_2}{y_1} = \frac{1}{(1.25)^2}$$
$$= 0.64$$

y is decreased by 36%.

15. **D**

Let $z = as + \frac{b}{t^2}$, where a and b are non-zero constants.

$$\begin{cases} 13 = a + b \\ -5 = 3a + \frac{b}{4} \end{cases}$$

Solving, we have $a = -3$ and $b = 16$.

$$\text{Required value} = -3(-2) + \frac{16}{(-4)^2} = 7$$

20. **A**

$$(-2)^3 - k(-2)^2 + 8(-2) - 4 = 0$$

$$k = -7$$

21. **D**

Let the height of frustum be h cm.

$$\left(\frac{h}{30}\right)^3 = \frac{\frac{1}{3}\pi(12)^2(30) - 1260\pi}{\frac{1}{3}\pi(12)^2(30)}$$

$$\frac{h}{30} = \sqrt[3]{\frac{1}{8}}$$

$$h = 15$$

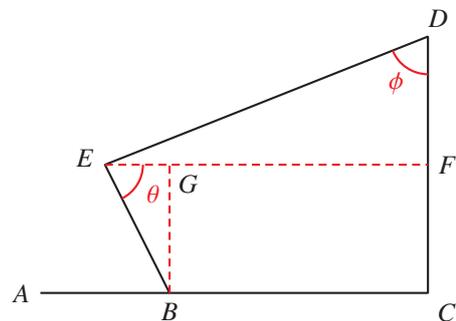
22. **A**

Let F be a point on CD such that $EF \perp CD$.

Let G be a point on EF such that $BG \perp EF$.

$$BC = EF - EG$$

$$= DE \sin \phi - BE \cos \theta$$



23. **B**

Let $BE = 1$ cm. Then $CE = 2$ cm and $AD = 6$ cm.

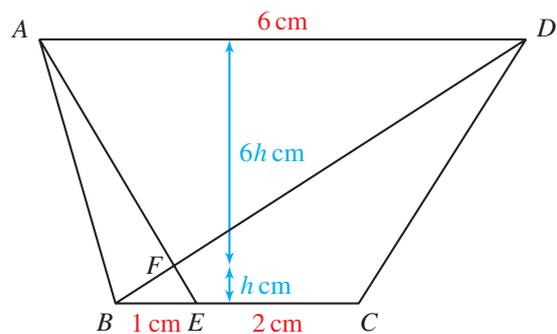
$\triangle ADF \sim \triangle EBF$ (ratio 6 : 1)

$$6 = \frac{(1)(7h)}{2} - \frac{(1)(h)}{2}$$

$$h = 2$$

$$\text{Required area} = \frac{(3)(7h)}{2} - \frac{(1)(h)}{2}$$

$$= 20 \text{ cm}^2$$



24. C

Let $\angle PRQ = \theta$.

Since $PQ = QR = RS$, we have $\angle QSR = \angle SQR = \theta$.

Since $\widehat{PS} : \widehat{RS} = 2 : 1$, we have $\angle PRS = 2\theta$.

In $\triangle QRS$,

$$\theta + (\theta + 2\theta) + \theta = 180^\circ$$

$$\theta = 36^\circ$$

$$\angle PES = 2\theta + \theta = 108^\circ$$

25. B

Let $\angle PRM = x$.

Since $ON = NR$, we have $\angle NOR = x$.

$$\angle QMR = \frac{\angle NOR}{2} = \frac{x}{2}$$

In $\triangle MQR$,

$$x + \frac{x}{2} = 36^\circ$$

$$x = 24^\circ$$

26. B

Since $\widehat{PS} = \widehat{SR}$, we have $\angle POS = \angle ROS = \frac{136^\circ}{2} = 68^\circ$.

Since $OP = OS$, we have $\angle SPO = \angle PSO = \frac{180^\circ - 68^\circ}{2} = 56^\circ$.

27. D

Let each exterior angle be x .

$$x + (x + 140^\circ) = 180^\circ$$

$$x = 20^\circ$$

I. ✗. $n = \frac{360^\circ}{20^\circ} = 18$

II. ✓.

III. ✓.

28. B

$$\frac{m}{m+40} = \frac{2}{m}$$

$$m^2 = 2m + 80$$

$$m^2 - 2m - 80 = 0$$

$$m = 10 \quad \text{or} \quad -8 \text{ (rejected)}$$

29. C

The data is concentrated near larger weights.

The maximum, upper quartile and median should appear closed to each other.

The answer is C.

30. B

I. Median = 4.

Since all numbers are not less than 4, mean \geq 4.

II. Mode = median = 4

III. .

31. A

The three expressions are $2^2m^2n^5$, $2 \cdot 3m^3n^3$ and $2^3m^5n^4$.

The H.C.F. is $2m^2n^3$.

32. C

$$y = 3x^2$$

$$\log y = 2 \log x + \log 3$$

I. .

II. . There is no y-intercept indeed, we have only the log y-intercept.

III. . $y = 3x^2$

$$\log_3 y = 2 \log_3 x + \log_3 3$$

Slope of the line is also 2.

33. **A**

$$\alpha + \beta = -\frac{1}{2} \text{ and } \alpha\beta = -\frac{k}{2}$$

$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$$

$$= \left(-\frac{1}{2}\right)^2 - 2\left(-\frac{k}{2}\right)$$

$$= \frac{1 + 4k}{4}$$

34. **D**

$6 = 110_2$ and only option D satisfies this.

35. **D**

Line	x-intercept	y-intercept
$3x + 4y = 120$	40	30
$x - 2y + 10 = 0$	-10	5
$y = 6$		6
$x = 10$	10	

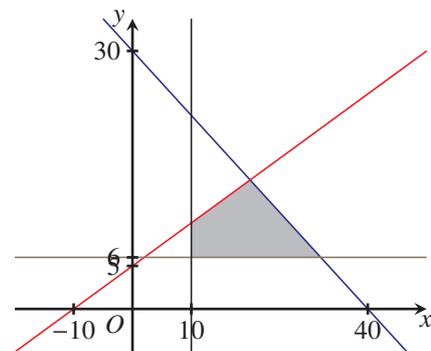
Sketch the graph using the intercepts.

Value of $2x + 3y + 20$ is greater when x and y are larger, i.e., the top right corners.

The coordinates of the top right corners are (20, 15) and (32, 6).

(x, y)	(20, 15)	(32, 6)
$2x + 3y + 20$	105	102

Required value = 105



36. **A**

$$x\text{-coordinate of vertex} = \frac{-30}{2(-5)} = 3$$

$$38 = -5(3)^2 + 30(3) + k$$

$$k = -7$$

37. **B**

$$\frac{9i^{13} + 8i^{14} + 7i^{15} + 6i^{16} + 5i^{17}}{1+i} = \frac{9i - 8 - 7i + 6 + 5i}{1+i}$$

$$= \frac{-2 + 7i}{1+i}$$

$$= \frac{5}{2} + \frac{9}{2}i$$

Imaginary part = $\frac{9}{2} = 4.5$

38. **C**

$$7 \cos^2 x = \cos x + 6$$

$$7 \cos^2 x - \cos x - 6 = 0$$

$$\cos x = 1 \quad \text{or} \quad -\frac{6}{7}$$

When $\cos x = 1$, $x = 0^\circ$ (exclude 360°)

When $\cos x = -\frac{6}{7}$, $x = 180^\circ - \cos^{-1} \frac{6}{7}$ or $180^\circ + \cos^{-1} \frac{6}{7}$

There are 3 roots.

39. **D**

Solve the system $\begin{cases} x - 2y + 1 = 0 \\ x^2 + y^2 - 6x + k = 0 \end{cases}$ using the calculator program.

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

Required range does not contain $k = 0$ and 0 is not a boundary value of the required range.

The answer is D.

40. **B**

The coordinates of the vertices of the triangle are $(0, 0)$, $(6, 0)$ and $(0, 8)$.

Let the radius of inscribed circle be r .

By considering the area of the triangle,

$$\frac{(6)(8)}{2} = \frac{(6)(r)}{2} + \frac{(8)(r)}{2} + \frac{(\sqrt{6^2 + 8^2})(r)}{2}$$

$$r = 2$$

The coordinates of the incentre are $(2, 2)$.

41. **C**

$$y = f(x) \longrightarrow y = -f(x) \longrightarrow y = -f(x - 2)$$

Reflect about the x -axis. Translate rightwards by 2 units.

The answer is C.

42. **B**

Let the mean and standard deviation be \bar{x} marks and σ marks respectively.

$$\begin{cases} \frac{78 - \bar{x}}{\sigma} = 1 \\ \frac{66 - \bar{x}}{\sigma} = -0.5 \end{cases}$$

Solving, we have $\bar{x} = 70$ and $\sigma = 8$.

43. **B**

$$\begin{aligned} \text{Required number} &= C_3^{18} \times C_4^{22} \\ &= 5\,969\,040 \end{aligned}$$

44. **D**

$$\begin{aligned} \text{Required probability} &= \frac{14 - 5}{14} \\ &= \frac{9}{14} \end{aligned}$$

45. **C**

I. \checkmark . Both ranges are equal to $f - a$.

II. \times . Take $P = \{1, 2, 3, 99, 1000, 1001\}$. Median of $P = 51$ and $x = 351$.

$$\text{Median of } Q = 99 - 3 = 96 > 51$$

III. \checkmark . Standard deviation of Q is equal to the standard deviation of the set $\{a, b, c, d, e, f, x\}$, which has a smaller standard deviation than P .