

**30 LIKELY JUPEB MATHEMATICS QUESTION**

1. The position of an object in motion at any time (t) is given by  $s = 3t^3 - 5t - 2$ . Obtain the velocity of the object after 2 seconds.

- A. 31m/s  
B. 36m/s  
C. 18m/s  
D. 20m/s

$$\begin{aligned}S &= 3t^3 - 5t - 2 \quad t = 2 \\ \frac{d}{dt} &= 9t^2 - 5 \\ &= 9(2)^2 - 5 \\ &= 9 \times 4 - 5 \\ &= 36 - 5 = 31 \text{ m/s}\end{aligned}$$

2. Find the derivative of  $2x^3 - 5x^2 + 2$

A.  $x^2 - 10x$

B.  $6x^2 - 10x$

C.  $-10x - 6x^2$

D.  $6x - 10$ .

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

$$3 \times 2x^{3-1} - 2 \times 5x^{2-1}$$

$$6x^2 - 10x$$

3. Find the derivative of  $y = (3 + 2x)(1 - x)$

A.  $-1 - 4x$

B.  $4x - 1$

C.  $-4x + 1$

D.  $-4x$

$$y = (3 + 2x)(1 - x)$$

$$\frac{d}{dx}(3 + 2x)(1 - x) + (3 + 2x)\frac{d}{dx}(1 - x)$$

$$(2)(1 - x) + (3 + 2x)(-1)$$

$$2 - 2x - 3 - 2x$$

$$\underline{\underline{-1 - 4x}}$$

4. Differentiate  $(x + y)^2 = 5$ .

A. -4

B. -2

C. -1

D. 10

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

$$2(x + y) \frac{d}{dx}(x + y) = 0$$

$$2(x + y) \left( 1 + \frac{dy}{dx} \right) = 0$$

Since  $x + y \neq 0$

$$2 \left( 1 + \frac{dy}{dx} \right) = 0$$

$$1 + \frac{dy}{dx} = 0$$

$$\frac{dy}{dx} = -1$$

5. Evaluate:  $\lim_{X \rightarrow 5} \frac{X^2 - 25}{X - 5}$

$$(x^2 - 25) \frac{d}{dx}$$

A. 5

B. 15

C. 10

D. 12

$$\begin{aligned} & 2x \\ & (x-5) \frac{d}{dx} = 1 \\ \lim_{x \rightarrow 5} & = \frac{2x}{1} = \frac{2(5)}{1} = 10 \end{aligned}$$

6. If  $y = (x - 1) e^{-x}$ , find  $\frac{dy}{dx}$

A.  $(2 - x) e^{-x}$

B.  $e^x 2x$

C.  $-x e^x$

D.  $2x$

$$y = (x - 1) e^{-x}$$

$$\frac{d}{dx} (x - 1) e^{-x} + (x - 1) \frac{d}{dx} (e^{-x})$$

$$(1)(e^{-x}) + (x - 1) - e^{-x}$$

$$e^{-x} + x - 1 - e^{-x} \Rightarrow e^{-x} + x - 1 - e^{-x}$$

$$e^{-x} (1 - x + 1)$$

$$e^{-x} (2 - x)$$

$$e^{-x} + e^{-x}(-x + 1)$$

$$e^{-x} (1 + (-x + 1))$$

$$e^{-x} (1 - x + 1)$$

$$e^{-x} (2 - x)$$

7. Find the modulus of  $2i + 3j - 4k$

A.  $\sqrt{12}$

B.  $\sqrt{29}$

C.  $\sqrt{3}$

D.  $\sqrt{28}$ .

$$\begin{aligned} & 2i + 3j - 4k \\ \text{Modulus} &= \sqrt{i^2 + j^2 + k^2} \\ &= \sqrt{2^2 + 3^2 + 4^2} \\ &= \sqrt{4 + 9 + 16} \\ &= \sqrt{29} \end{aligned}$$

8. Find the scalar products of  $a = 2i + 3j$  and  $b = -i + 4j$

$$\begin{aligned}a &= 2i + 3j \\b &= -i + 4j \\a \cdot b &= (2)(-1) + (3)(4) \\&= -2 + 12 \\&= 10\end{aligned}$$

A. 20

B. 10

C. -10

D. -20

9. Find the value of  $n$  for which the vector  $si + nj - 3k$  and  $ni - j + 5k$  are perpendicular.

A. 90

B.  $0^\circ$

C.  $\frac{15}{s-1}$

D.  $\frac{s-1}{15}$

$$si + nj - 3k$$

$$ni - j + 5k$$

$$(si + nj - 3k) \cdot (ni - j + 5k) = 0$$

$$sn - n - 15 = 0$$

$$n(s-1) = 15$$

$$n = \frac{15}{s-1}$$

10. Find the centre and radius of the circle  $8x^2 + 8y^2 - 24x - 40y + 18 = 0$ .

- A.  $(3/2, 5/2)$  and  $r = 3/2$   
 B.  $(-3/2, 5/2)$  and  $r = 5/2$   
 C.  $(3/2, -5/2)$  and  $r = 3/2$   
 D.  $(3/2, 5/2)$  and  $r = 5/2$

$$8x^2 + 8y^2 - 24x - 40y + 18 = 0$$

$$8x^2 + 8y^2 - 24x - 40y = -18$$

$$8(x^2 + y^2 - 3x - 5y) = -18$$

$$x^2 + y^2 - 3x - 5y = -\frac{18}{8}$$

$$x^2 + y^2 - 3x - 5y = -\frac{9}{4}$$

for x

$$x^2 - 3x = \left(x - \frac{3}{2}\right)^2 - \frac{9}{4}$$

for y

$$y^2 - 5y = \left(y - \frac{5}{2}\right)^2 - \frac{25}{4}$$

$$\left(x - \frac{3}{2}\right)^2 - \frac{9}{4} + \left(y - \frac{5}{2}\right)^2 - \frac{25}{4} = -\frac{9}{4}$$

$$\left(x - \frac{3}{2}\right)^2 + \left(y - \frac{5}{2}\right)^2 - \frac{34}{4} = -\frac{9}{4}$$

$$\left(x - \frac{3}{2}\right)^2 + \left(y - \frac{5}{2}\right)^2 = \frac{34}{4} - \frac{9}{4}$$

$$\left(x - \frac{3}{2}\right)^2 + \left(y - \frac{5}{2}\right)^2 = \frac{25}{4}$$

$$(x - h)^2 + (y - k)^2 = r^2$$

$$\left(\frac{3}{2}, \frac{5}{2}\right) \text{ — Centre}$$

$$r^2 = \frac{25}{4} \Rightarrow r = \sqrt{\frac{25}{4}} = \frac{5}{2}$$

11. Find the equation of the tangent to the circle  
 $2x^2 + 2y^2 = 30$  at the point  $(-3, 6)$ .

- A.  $x + y - 15 = 0$   
 B.  $x - 2y + 5 = 0$   
 C.  $x + 2y - 5 = 0$   
 D.  $x - 2y + 15 = 0$  6.

$$2x^2 + 2y^2 = 30$$

$$x^2 + y^2 = 15$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - 0}{-3 - 0} = \frac{6}{-3} = -2$$

$$m_t = \frac{1}{2}$$

slope =

$$y - y_1 = m(x - x_1)$$

$$y - 6 = \frac{1}{2}(x - (-3))$$

$$y - 6 = \frac{1}{2}(x + 3)$$

$$(y - 6)^2 = x + 3$$

$$2y - 12 = x + 3$$

$$x + 3 - 2y + 12 = 0$$

$$x - 2y + 15 = 0$$

12. Find the gradient of the curve  $y = x^3 - 6x^2 + 11x - 6$  at the point  $(1, 0)$

A. -1

B. -2

C. 1

D. 2

$$y = x^3 - 6x^2 + 11x - 6$$

$$\frac{d}{dx} = 3x^2 - 12x + 11$$

$$= 3(1)^2 - 12(1) + 11$$

$$= 3 - 12 + 11$$

$$= 14 - 12 = 2$$

13. Given sets  $A = \{a, b, 1, 3\}$  and  $B = \{a, 2, 4\}$ , find  $A \cup B$ .  $= \{a, b, 1, 2, 3, 4\}$

A.  $\emptyset$

B.  $\{a, b, 1, 2, 3, 4\}$

C.  $\{a, b, 1, 3\}$

D.  $\{b, 1, 2, 3, 4\}$ .

14. Let  $P$  be the set of prime factors of 42 and  $Q$  be the set of prime factors of 45. Find  $P \cap Q$ .

A. 2

B. 3

C. 7

D. 5

$$\begin{array}{r|l} 2 & 42 \\ \hline 3 & 21 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$
$$\begin{array}{r|l} 5 & 45 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$$42 = \{2, 3, 7\} = P$$

$$45 = \{3, 5\} = Q$$

$$P \cap Q = \{3\}$$

15. For what values of  $k$  will the equation  $y^2 - (k-2)y + 1 = -2k$  have real equal roots?

A. 0, 12

B. 3, 4

C. 0, 3

D. -3, 4

$$y^2 - (k-2)y + 1 = -2k$$

$$y^2 - (k-2)y + 1 + 2k = 0$$

$$y^2 - (k-2)y + 2k+1 = 0$$

$$a=1 \quad b=-(k-2) \quad c=(2k+1)$$

$$\Delta = b^2 - 4ac$$

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

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

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

$$k^2 - 4k + 4 - 8k - 4 = 0$$

$$(-k+2)^2 = (-k+2)(-k+2)$$

$$k^2 - 2k - 2k + 4$$

$$k^2 - 4k + 4$$

$$k^2 - 4k = 0$$

$$k(k-4) = 0$$

$$k = 0$$

$$k-4 = 0$$

$$k = 0, 4$$

16. Which of the following is correct?

A.  $270^\circ = 2\pi$  radians  $\times$

B.  $360^\circ = 3\pi$  radians  $\times$

C.  $90^\circ = \pi$  radians  $\times$

D.  $720^\circ = 4\pi$  radians  $\checkmark$

$$180^\circ = \pi \text{ radi}$$

$$270^\circ = \frac{270}{180} = \frac{3}{2}\pi$$

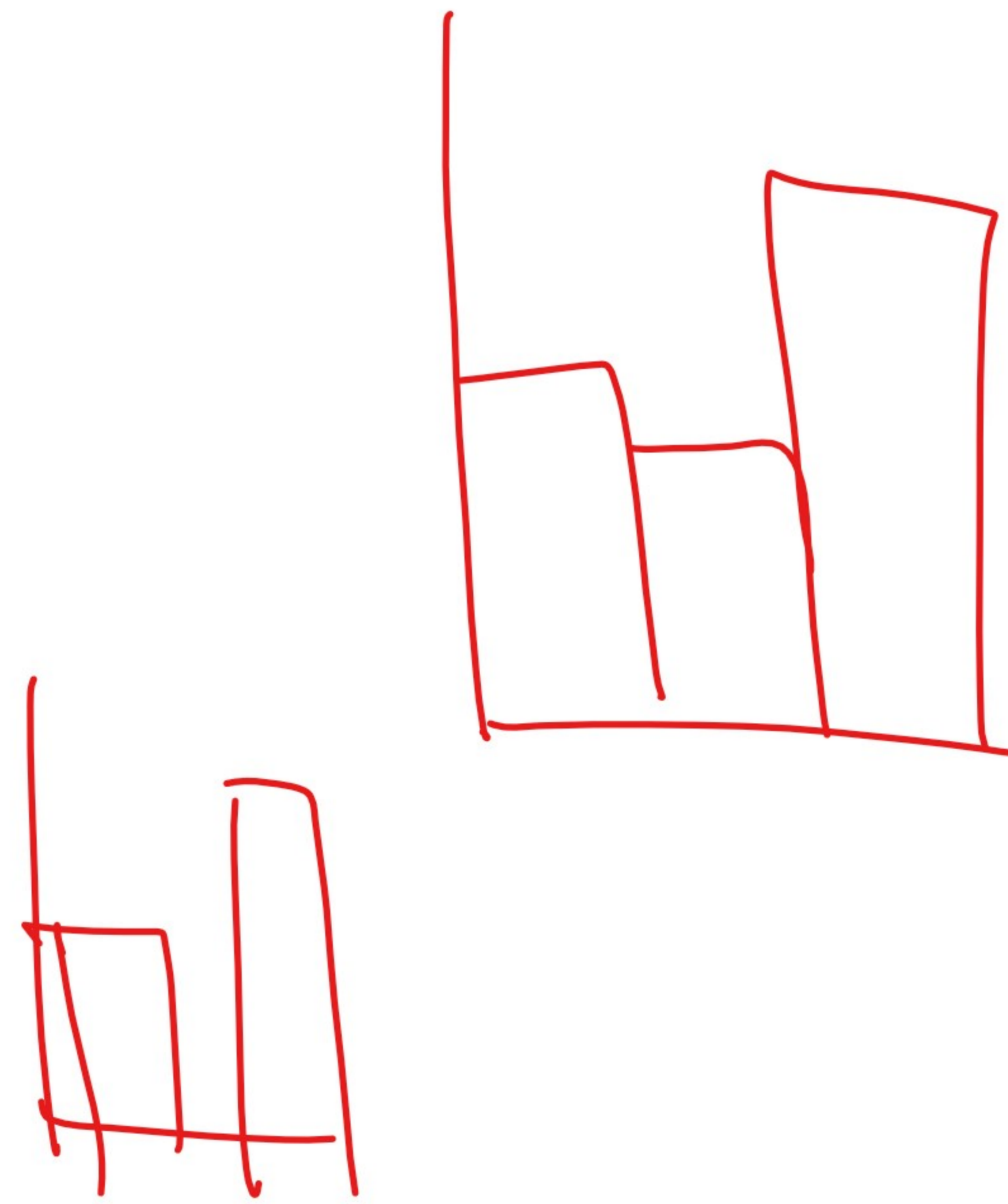
$$360^\circ = \frac{360}{180} = 2\pi$$

$$90^\circ = \frac{90}{180} = \frac{1}{2}\pi$$

$$720^\circ = \frac{720}{180} = 4\pi$$

17. Data representation in which the bars are joined together is called

- A. pictogram.
- B. bictogram.
- C. histogram. ✓
- D bar chart.



18. If  $f(x) = 3x^2 - 5x + 2$ , find  $f(2)$ .

A. 4

B. 6

C. 8

D. 12

$$\begin{aligned} f(2) &= 3(2)^2 - 5(2) + 2 \\ &= 3 \times 4 - 10 + 2 \\ &= 12 - 10 + 2 \\ &= 2 + 2 \\ &= 4 \end{aligned}$$

19. Solve for  $x$  if  $2^{x+1} = 16$ .

A. 2

B. 3

C. 4

D. 5

$$2^{x+1} = 16$$

$$2^{x+1} = 2^4$$

$$x+1 = 4$$

$$x = 4 - 1 = 3$$

20. Find the gradient of the line joining the points (2, 3) and (6, 11).

A. 1

B. 2

C. 3

D. 4

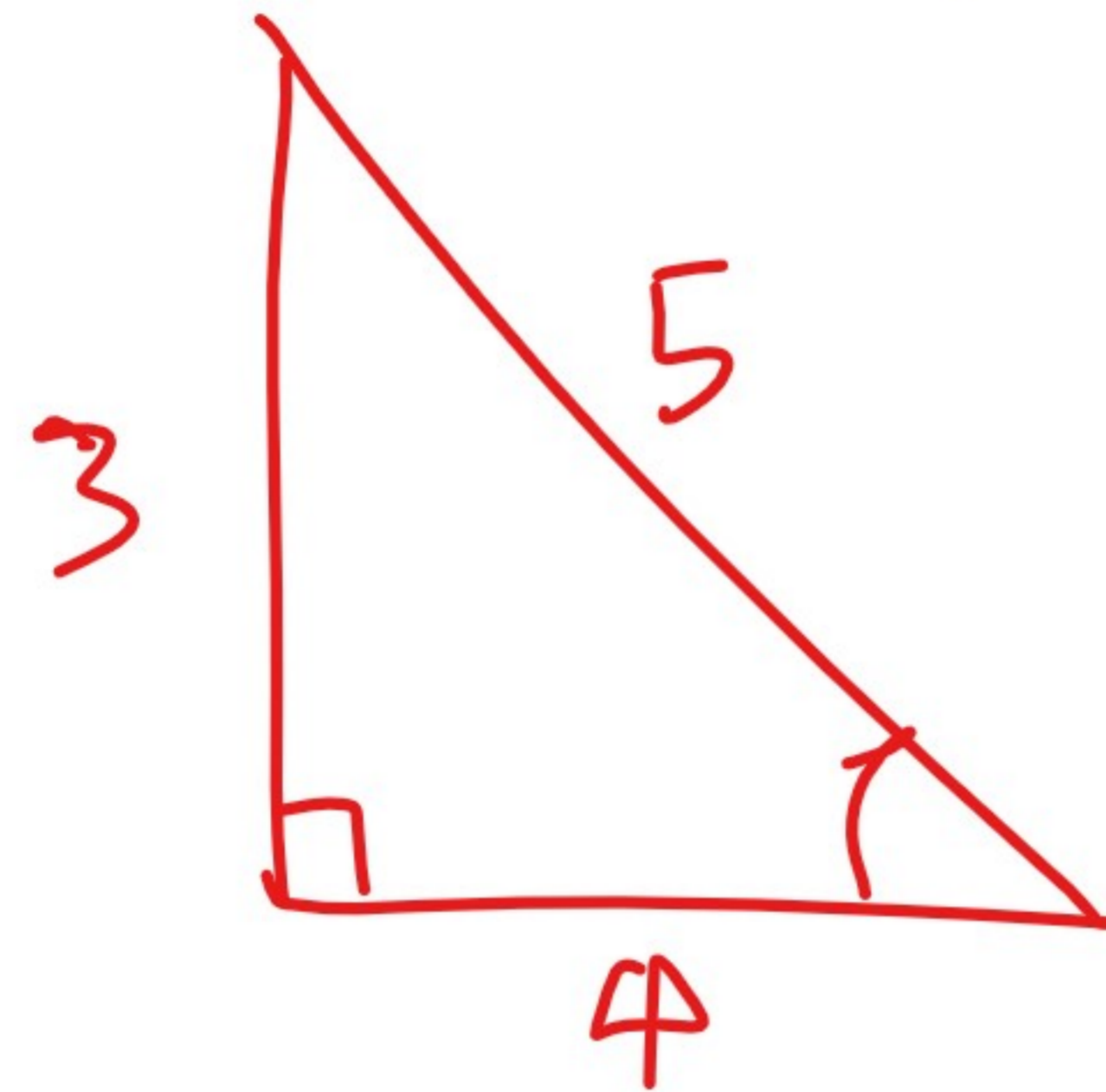
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{11 - 3}{6 - 2} = \frac{8}{4} = 2$$

21. If  $\sin \theta = \frac{3}{5}$  and  $\theta$  is acute, find  $\cos \theta$ .

- A.  $\frac{3}{4}$   
 B.  $\frac{4}{5}$   
 C.  $\frac{3}{5}$   
 D.  $\frac{4}{5}$

$$\sin \theta = \frac{3}{5} = \frac{\text{opp}}{\text{hyp}}$$



$$\text{Hyp}^2 = \text{opp}^2 + \text{Adj}^2$$

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

$$25 - 9 = x^2$$

$$16 = x^2 = \sqrt{16} = 4$$

$$\cos \theta = \frac{\text{Adj}}{\text{Hyp}} = \frac{4}{5}$$

22. Evaluate  $\log_{10} 1000$ .

- A. 2
- B. 3
- C. 10
- D. 100

$$\begin{aligned} & \log_{10} 1000 \\ & \log_{10} 10^3 \\ & 3 \log_{10} 10 \\ & \log_{10} 10 = 1 \quad = 3 \times 1 = 3 \end{aligned}$$

23. The sum of the first 10 terms of an arithmetic progression is 155. If the first term is 5, find the common difference.

A. 2

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

B. 3

$$S_{10} = \frac{10}{2} [2(5) + (10-1)d]$$

C. 4

$$155 = 5(10 + 9d)$$

D. 5

$$155 = 50 + 45d$$

$$155 - 50 = 45d$$

$$105 = 45d$$

$$4 = \frac{105}{45} = \frac{7}{9} = \frac{7}{3} = 2\frac{1}{3}$$

24. Differentiate  $y = 4x^3 - 7x + 6$  with respect to  $x$ .

A.  $12x^2 - 7$

B.  $4x^2 - 7$

C.  $12x^2 + 7$

D.  $3x^2 - 7$

$$\begin{aligned}\frac{d}{dx} &= 3 \times 4x^{3-1} - 1 \times 7x^{1-1} \\ &= 12x^2 - 7 \\ &= 12x^2 - 7\end{aligned}$$

25. Find the value of  $k$  if the points  $(1, k)$ ,  $(3, 7)$ , and  $(5, 11)$  lie on a straight line.

A. 1

$$(1, k)(3, 7) = \frac{7-k}{3-1} = \frac{7-k}{2}$$

B. 2

$$(3, 7)(5, 11) = \frac{11-7}{5-3} = \frac{4}{2} = 2$$

C. 3

D. 4

$$\frac{7-k}{2} = 2 \Rightarrow 7-k = 4$$

$$k = 7 - 4 = 3$$

26. Evaluate  $\int 6x^2 dx$ .

A.  $2x^3 + C$

B.  $6x^3 + C$

C.  $3x^2 + C$

D.  $x^3 + C$

$$\frac{6x^{2+1}}{2+1} + C$$

$$\cancel{\frac{6x^3}{3}} + C$$

$$2x^3 + C$$

27. If  $|x - 4| = 6$ , find the possible values of  $x$ .

- A. 2 and 10
- B. -2 and 10
- C. -10 and 2
- D. -2 and -10

$$|x - 4| = 6$$

$$x - 4 = 6 \Rightarrow x = 6 + 4 = 10$$

$$x - 4 = -6 \Rightarrow x = -6 + 4 = -2$$

28. The roots of the equation  $x^2 - 5x + 6 = 0$   
are

A. 1 and 6

B. 2 and 3

C. -2 and -3

D. -1 and -6

$$\begin{aligned}
 &x^2 - 5x + 6 = 0 \\
 &\quad \quad \quad \swarrow \quad \searrow \\
 &\quad \quad \quad 6x^2 \\
 &\quad \quad \quad \swarrow \quad \searrow \\
 &\quad \quad \quad -3x \quad -2x \\
 & (x^2 - 3x) - (2x + 6) \\
 & x(x-3) - 2(x+3) \\
 & x=3 \quad x=2 \\
 & x=2 \quad x=3
 \end{aligned}$$

29. Find the value of  $\tan 45^\circ + \sin 30^\circ$ .

- A.  $\frac{1}{2}$
- B.  $\frac{3}{2}$
- C. 1
- D. 2

$$\tan 45 = 1$$

$$\sin 30 = \frac{1}{2}$$

$$1 + \frac{1}{2} = \frac{3}{2}$$

30. If a matrix

$$A = \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix},$$

find  $|A|$ .

A. 5

B. 7

C. 8

D. 11

$$\begin{aligned} |A| &= 2 \times 4 - 3 \times 1 \\ &= 8 - 3 = 5 \end{aligned}$$