

$$\begin{aligned}
 1. \quad u_{n+1} &= 0.3u_n + 6 & u_{10} &= 10 \\
 u_{11} &= 0.3(10) + 6 \\
 &= 9 \\
 u_{12} &= 0.3(9) + 6 \\
 &= 8.7
 \end{aligned}$$

Answer: C

$$\begin{aligned}
 2. \quad c(-7, 6) \\
 r = 6 \\
 (x+7)^2 + (y-6)^2 = 36
 \end{aligned}$$

Answer: D

$$\begin{aligned}
 3. \quad \underline{u} &= \begin{pmatrix} k \\ -1 \\ 1 \end{pmatrix} & \underline{v} &= \begin{pmatrix} 0 \\ 4 \\ k \end{pmatrix} \\
 \text{If } \underline{u} \perp \underline{v} & \text{ then } \underline{u} \cdot \underline{v} = 0 \\
 \Rightarrow k \cdot 0 + (-1) \cdot 4 + 1 \cdot k &= 0 \\
 k - 4 &= 0 \\
 k &= 4
 \end{aligned}$$

Answer: C

$$\begin{aligned}
 4. \quad u_{n+1} &= 0.4u_n - 240 \\
 \text{limit exists as } &-1 < 0.4 < 1 \\
 L &= 0.4L - 240 \\
 0.6L &= -240 \\
 L &= -400
 \end{aligned}$$

Answer: B

$$\begin{aligned}
 5. \quad c(2, 5) \quad \tau(7, 9) \\
 m_r &= \frac{9-5}{7-2} \\
 &= \frac{4}{5} \\
 \Rightarrow m_T &= -\frac{5}{4} \quad \text{as } m_1 m_2 = -1 \\
 & \quad \text{for } \perp \text{ lines}
 \end{aligned}$$

Answer: A

6. $2\sin x - \sqrt{3} = 0$

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

$$(x^\circ = 60^\circ, 120^\circ)$$

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

$$x = \frac{2\pi}{3} \quad \text{where} \quad \frac{\pi}{2} \leq x \leq \pi$$

Answer: B

7. $m = \tan 135^\circ$

$$m = -1$$

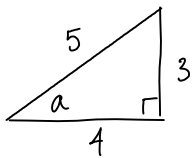
Answer: C

8. $y = -f(x-2)$

\uparrow reflected on x-axis
 \uparrow moved right 2

Answer: D

9. $\sin a = \frac{3}{5}$



$$\cos a = \frac{4}{5}$$

$$\sin(x+a) = \sin x \cos a + \cos x \sin a$$

$$= \frac{4}{5} \sin x + \frac{3}{5} \cos x$$

Answer: B

10. $x^2 + x + 1 = 0$

$$b^2 - 4ac = (1)^2 - 4(1)(1)$$

$$= 1 - 4$$

$$= -3$$

$$b^2 - 4ac < 0 \Rightarrow \text{no real roots}$$

Answer: A

11. $E(-2, -1, 4)$ $P(1, 5, 7)$ $F(7, 17, 13)$

$$\vec{EP} = \begin{pmatrix} 3 \\ 6 \\ 3 \end{pmatrix} \quad \vec{PF} = \begin{pmatrix} 6 \\ 12 \\ 6 \end{pmatrix}$$
$$= 3 \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix} \quad = 6 \begin{pmatrix} 1 \\ 2 \\ 1 \end{pmatrix}$$

$$\vec{EP} : \vec{PF} = 3 : 6$$
$$= 1 : 2$$

Answer: B

12. $\vec{VT} = \vec{VW} + \vec{WS} + \vec{ST}$

$$= -\underline{f} - \underline{h} + \underline{g}$$
$$= -\underline{f} + \underline{g} - \underline{h}$$

Answer: C

13. roots are 1 and 4

$$\Rightarrow y = k(x-1)(x-4)$$
$$y = k(x^2 - 5x + 4)$$

$$y\text{-intercept} = 12$$
$$= 3 \times 4$$
$$\Rightarrow k = 3$$

Answer: A

14. $\int 4 \sin(2x+3) dx$

$$= \frac{-4 \cos(2x+3)}{2} + C$$
$$= -2 \cos(2x+3) + C$$

Answer: B

15. $\frac{d}{dx} (x^3+4)^2 = 2(x^3+4) \cdot 3x^2$

$$= 6x^2(x^3+4)$$

Answer: C

$$\begin{aligned}
 16. \quad & 2x^2 + 4x + 7 \\
 & = 2(x^2 + 2x) + 7 \\
 & = 2[(x+1)^2 - 1] + 7 \\
 & = 2(x+1)^2 - 2 + 7 \\
 & = 2(x+1)^2 + 5
 \end{aligned}$$

Answer : A

$$17. \quad f(x) = \sqrt{9-x^2}$$

$9-x^2$ cannot be < 0

x cannot be > 3 or < -3

$$\Rightarrow -3 \leq x \leq 3$$

Answer : C

$$18. \quad |p| = 3 \quad |q| = 4 \quad p \cdot q = 10$$

$$\begin{aligned}
 & q \cdot (p + q) \\
 & = q \cdot p + q \cdot q \\
 & = 10 + 4^2 \\
 & = 10 + 16 \\
 & = 26
 \end{aligned}$$

Answer : C

$$19. \quad y = 2m^x \quad P(3, 54)$$

$$54 = 2m^3$$

$$27 = m^3$$

$$m = 3$$

Answer : B

$$20. \quad y = \log_3(x-4) \quad P(q, 2)$$

$$2 = \log_3(q-4)$$

$$3^2 = q-4$$

$$q = q-4$$

$$q = 13$$

Answer : D

21. (a) $f(x) = x^3 - 3x + 2$

$$f'(x) = 3x^2 - 3$$

for stat pts $f'(x) = 0$

$$3x^2 - 3 = 0$$

$$x^2 - 1 = 0$$

$$(x+1)(x-1) = 0$$

$$\Rightarrow x = -1, 1$$

$$f(-1) = (-1)^3 - 3(-1) + 2$$

$$= -1 + 3 + 2$$

$$= 4$$

$$f(1) = (1)^3 - 3(1) + 2$$

$$= 1 - 3 + 2$$

$$= 0$$

| | | | |
|---------|------------------|-----------------|---------------|
| x | $\rightarrow -1$ | $\rightarrow 1$ | \rightarrow |
| $f'(x)$ | $+$ | 0 | $-$ |
| shape | $/$ | $-$ | \backslash |

Max T.P. at $(-1, 4)$

Min T.P. at $(1, 0)$

(b) (i) $x = 1$

| | | | |
|---|---|----|----|
| 1 | 0 | -3 | 2 |
| | 1 | 1 | -2 |
| 1 | 1 | -2 | 0 |

 $\Rightarrow (x-1)$ is a factor

(ii) Quotient = $x^2 + x - 2$

$$f(x) = (x-1)(x^2 + x - 2)$$

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

$$= (x+2)(x-1)^2$$

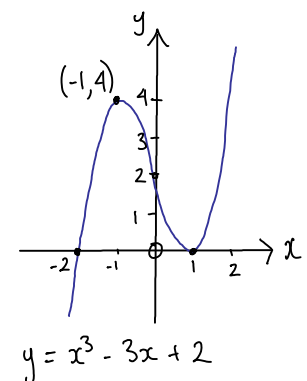
(c) on x -axis, $y = 0$

$$\Rightarrow (x+2)(x-1)^2 = 0$$

$$x = -2, 1 \quad (-2, 0) (1, 0)$$

on y -axis, $x = 0$

$$\Rightarrow y = 2 \quad (0, 2)$$



$$22 \text{ (a)} \quad y = x^3 - 6x^2 + 8x$$

$$\frac{dy}{dx} = 3x^2 - 12x + 8$$

when $m = -1$

$$3x^2 - 12x + 8 = -1$$

$$3x^2 - 12x + 9 = 0$$

$$x^2 - 4x + 3 = 0$$

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

$$x = 1, 3$$

When $x = 1$,

$$y = (1)^3 - 6(1)^2 + 8(1)$$

$$y = 1 - 6 + 8$$

$$y = 3$$

$$(1, 3)$$

when $x = 3$

$$y = (3)^3 - 6(3)^2 + 8(3)$$

$$y = 27 - 54 + 24$$

$$y = -3$$

$$(3, -3)$$

$$(b) \quad y = 4 - x$$

$m = -1 \Rightarrow$ point A either $(1, 3)$ or $(3, -3)$

$$(3) = 4 - (1) \quad (-3) = 4 - (3)$$

$$\text{LHS} = \text{RHS}$$

$$\text{LHS} \neq \text{RHS}$$

$$\Rightarrow A(1, 3)$$

$$23. \quad f(x) = x^2 - x + 10 \quad g(x) = 5 - x \quad h(x) = \log_2 x$$

$$(a) \quad h(f(x)) = h(x^2 - x + 10) \\ = \log_2(x^2 - x + 10)$$

$$h(g(x)) = h(5 - x) \\ = \log_2(5 - x)$$

$$(b) \quad h(f(x)) - h(g(x)) = 3$$

$$\log_2(x^2 - x + 10) - \log_2(5 - x) = 3$$

$$\log_2\left(\frac{x^2 - x + 10}{5 - x}\right) = 3$$

$$\frac{x^2 - x + 10}{5 - x} = 2^3$$

$$x^2 - x + 10 = 8(5 - x)$$

$$x^2 - x + 10 = 40 - 8x$$

$$x^2 + 7x - 30 = 0$$

$$(x+10)(x-3) = 0$$

$$\Rightarrow x = -10, 3$$