

$$1. (3-2x)(1+\frac{x}{2})^n$$

$$= (3-2x)(1 + \binom{n}{1}x\frac{x}{2} + \dots)$$

$$= -2x + \binom{n}{1}x\frac{3}{2}x$$

$$\ominus -2 + \binom{n}{1}x\frac{3}{2} = 7$$

$$\binom{n}{1} = 6$$

$$n = 6$$

$$(3-2x)(1+3x+\frac{15}{4}x^2) = 5 \div d \times d = \text{given}$$

$$= -6x^2 + \frac{45}{4}x^2$$

$$= \frac{21}{4}x^2$$

$$2.(i) 81 \times r^3 = 24$$

$$r^3 = \frac{8}{27}$$

$$r = \frac{2}{3}$$

$$(ii) \frac{81}{1-\frac{2}{3}} = 243$$

$$(iii) 81 \times \frac{2}{3} = 54 \quad 54 \times \frac{2}{3} = 36$$

$$54 + 36 = 90$$

$$d = -6$$

$$S_{10} = \frac{10[54 + 54 + 9(-6)]}{2}$$

$$= 270$$



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$$3. (i) \angle BAD = \frac{1}{2} \pi \quad \tan \angle BAD = \frac{b}{b}$$

$$\sin \angle BAD = \frac{1}{2} \quad \angle BAD = \frac{1}{4} \pi$$

$$AB = \sqrt{b^2 + b^2} = b\sqrt{2}$$

$$\text{arc BD} = b\sqrt{2} \times \frac{1}{4} \pi = \frac{3}{2} \sqrt{2} \pi = 6.66$$

$$(ii) A_{ABD} = \frac{1}{2} \times (b\sqrt{2})^2 \times \frac{1}{4} \pi = 9\pi$$

$$A_{\triangle AOB} = 6 \times 6 \div 2 = 18$$

$$9\pi - 18 = 10.27$$

$$4. \text{Let } AB \text{ is } y = kx + b$$

$$\begin{cases} 1 = 3k + b \\ 3 = -k + b \end{cases}$$

$$\begin{cases} k = -\frac{1}{2} \\ b = \frac{5}{2} \end{cases}$$

$$\therefore BC: y = 2x + c$$

$$1 = 6 + c$$

$$c = -5$$

$$y = 2x - 5$$

$$\text{Let } OB: y = kx$$

$$1 = 3k$$

$$k = \frac{1}{3}$$

$$\therefore AC: y = \frac{1}{3}x + d$$



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$$3 = -\frac{1}{3} + d$$

$$d = \frac{10}{3}$$

$$y = \frac{1}{3}x + \frac{10}{3}$$

$$\frac{1}{3}x + \frac{10}{3} = 2x - 5$$

$$x = -5$$

$$y = -5$$

$$5 \text{ (i) } \frac{dy}{dx} = -(x-3)^2 + 1$$

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

$$\frac{d^2y}{dx^2} = 2(x-3)^{-3}$$

$$= \frac{2}{(x-3)^3}$$

$$\text{(ii) } -\frac{1}{(x-3)^2} + 1 = 0$$

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

$$(x-3)^2 = 1$$

$$x-3 = 1 \text{ or } x-3 = -1$$

$$x = 4 \text{ or } x = 2$$

$$\left(\frac{d^2y}{dx^2}\right)_{x=4} = 2 \text{ min}$$

$$\left(\frac{d^2y}{dx^2}\right)_{x=2} = -2 \text{ max}$$

\therefore Point A: (2, 1) ~~(4, 5)~~ Point B: (4, 5)

$$0 = x + 1 - x = 1 \text{ (iii)}$$

$$x = 3$$

$$x \text{ min } d = \dots$$



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$$\begin{aligned}
 6.(i) \text{ LHS} &= \frac{\cos \theta}{\frac{\sin \theta}{\cos \theta} (1 - \sin \theta)} \\
 &= \frac{\cos \theta}{\sin \theta (1 - \sin \theta)} \\
 &= \frac{\cos^2 \theta}{\sin \theta (1 - \sin \theta)} \\
 &= \frac{1 - \sin^2 \theta}{\sin \theta}
 \end{aligned}$$

$$\begin{aligned}
 \text{LHS} &= \frac{\cos \theta}{\frac{\sin \theta}{\cos \theta} - \frac{\sin^2 \theta}{\cos \theta}} \\
 &= \frac{1 - \sin^2 \theta}{\sin \theta - \sin^2 \theta} \\
 &= \frac{(1 + \sin \theta)(1 - \sin \theta)}{\sin \theta (1 - \sin \theta)} \\
 &= \frac{1}{\sin \theta} + 1 \\
 &= 1 + \frac{1}{\sin \theta}
 \end{aligned}$$

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

$$\begin{aligned}
 \text{ii } 1 + \frac{1}{\sin \theta} &= 4 \\
 \sin \theta &= \frac{1}{3}
 \end{aligned}$$

$$\theta = 19.47 \text{ or } 160.53$$

$$7(i) 2y + 3y + y + 3x + 4x + x = 48$$

$$6y + 8x = 48$$

$$y = -\frac{4}{3}x + 8$$

$$(ii) 3yx + 3xy = 6xy \quad x = y \quad y = x$$

$$6xy = 6x(-\frac{4}{3}x + 8)$$

$$= 48x - 8x^2$$

$$A = 48x - 8x^2$$

$$(iii) \frac{dA}{dx} = 48 - 16x = 0$$

$$x = 3$$

$$\frac{d^2A}{dx^2} = -16$$

$$\left(\frac{d^2A}{dx^2}\right)_{x=3} = -16 \text{ max}$$



$$8(i) \cancel{y=x^2+1} \quad y=x^2+1$$

$$\sqrt{y-1} = x$$

$$\therefore f^{-1}: x \mapsto \sqrt{x-1} \quad x \geq 1$$

$$(ii) f(x^2+1) = (x^2+1)^2+1 = \frac{185}{16}$$

$$x^2+1 = \frac{13}{4} \text{ or } x^2+1 = -\frac{13}{4} \text{ (drop)}$$

$$x = \pm \frac{3}{2}$$

$$\text{or } x = -\frac{3}{2} \text{ (drop)}$$

$$9(i) \frac{dy}{dx} = 3(3-2x)^2 x - 2$$

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

$$\left(\frac{dy}{dx}\right)_{x=\frac{1}{2}} = -24$$

$$\frac{y-8}{x-\frac{1}{2}} = -24 \quad y = -24x + 20$$

$$(ii) \int_0^{\frac{1}{2}} (3-2x)^3 dx$$

$$= \left[-\frac{1}{8}(3-2x)^4\right]_0^{\frac{1}{2}}$$

$$= -\frac{1}{8}\left(3-2 \times \frac{1}{2}\right)^4 + \frac{1}{8}(3-2 \times 0)^4$$

$$= -2 + \frac{81}{8}$$

$$= \frac{65}{8}$$

$$(8+20) \times \frac{1}{2} \div 2$$

$$= 7$$

$$\frac{65}{8} - 7 = \frac{9}{8}$$



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$$10. a \quad y = -2(x+2)^2 + (x+2) - 2$$

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

$$= -2x^2 - 7x - 8$$

b. The graph first ~~reversed~~ ^{reflect} to y -axis and the stretch ~~vertically~~ ^{horizontally} for $\frac{2}{3}$ ~~on~~ ^{to} y -axis.

$$c(i) (x-1)^2 + (y+2)^2 = 40$$

$$A(1, -2) \quad r = 2\sqrt{10}$$

$$(ii) (3-1)^2 + (4+2)^2 = 40.$$

$$4 + 36 = 40$$

$$40 = 40$$

$\therefore B$ lies on the circle

$$(iii) AB: y = kx + b$$

$$\begin{cases} -2 = k + b \\ 4 = 3k + b \end{cases}$$

$$\begin{cases} k = 3 \\ b = -5 \end{cases}$$

$$y = -\frac{1}{3}x + b$$

$$4 = -1 + b$$

$$b = 5$$

$$y = -\frac{1}{3}x + 5$$

$$y = -\frac{1}{3}x + 5$$

$$y = -\frac{1}{3}x + 5$$



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