Studybeesofficial

Where Minds Pollinate

Class 12
Mathematics

Chapter 2

Exercise 2.7

Handwritten Solution

Concept:

Chain Rule:-

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$

Implicit Differentiation.

when the relationship b/w x & y is given equation but y is not isolated

e.g $xy + y^2 = 4$

Exponential Derivative.

$$\frac{d}{dx}(e^x) = e^x \cdot \frac{d}{dx}(x)$$

Logarithmic Derivative.

$$\frac{d}{dx}(\ln x) = \frac{1}{x} \frac{d}{dx}(x)$$

Differentials:

$dy = f'(x)\Delta x = f'(x)dx$ if $\Delta x \approx dx$

$\Delta y = f(x+\Delta x) - f(x)$

Approximation.

$f(x+\Delta x) = f(x) + dy$

Exercise 2.7

Q1. $y = \left(x - \frac{1}{x^2}\right)^5$

Sol:- $\frac{dy}{dx} = 5\left(x - \frac{1}{x^2}\right)^4 \frac{d}{dx}\left(x - x^{-2}\right)$

$\frac{dy}{dx} = 5\left(x - \frac{1}{x^2}\right)^4 \left[1 - (-2x^{-3})\right]$

$\boxed{\frac{dy}{dx} = 5\left(x - \frac{1}{x^2}\right)^4 \left(1 + \frac{2}{x^3}\right)}$ Answer.

Q2. $f(x) = \left(\frac{x^2-1}{x^2+1}\right)^2$

Sol:- $f'(x) = 2\left(\frac{x^2-1}{x^2+1}\right) \frac{d}{dx}\left(\frac{x^2-1}{x^2+1}\right)$

$f'(x) = 2\left(\frac{x^2-1}{x^2+1}\right)\left[\frac{(x^2+1)\frac{d}{dx}(x^2-1) - (x^2-1)\frac{d}{dx}(x^2+1)}{(x^2+1)^2}\right]$

$f'(x) = 2\left(\frac{x^2-1}{x^2+1}\right)\left[\frac{(x^2+1)(2x) - (x^2-1)(2x)}{(x^2+1)^2}\right]$

$f'(x) = 4x\left(\frac{x^2-1}{x^2+1}\right)\left[\frac{x^2+1-x^2+1}{(x^2+1)^2}\right]$

$\boxed{f'(x) = \frac{8x(x^2-1)}{(x^2+1)^3}}$ Answer.

Q3) $y = (3x-1)^4(-2x+9)^5$

Sol:- $\frac{dy}{dx} = (3x-1)^4 \frac{d}{dx}(-2x+9)^5 + (-2x+9)^5 \frac{d}{dx}(3x-1)^4$

$\frac{dy}{dx} = (3x-1)^4\left[5(-2x+9)^4(-2)\right] + (-2x+9)^5\left[4(3x-1)^3(3)\right]$

$\frac{dy}{dx} = -10(3x-1)^4(-2x+9)^4 + 12(-2x+9)^5(3x-1)^3$

$$\frac{dy}{dx} = 2(3x-1)^3(-2x+9)^4\left[-5(3x-1)+6(-2x+9)\right]$$

$$\frac{dy}{dx} = 2(3x-1)^3(-2x+9)\left[-15x+5 \cancel{+} 12x+54\right)$$

$$\frac{dy}{dx} = 2(3x-1)^3(-2x+9)(-27x+59) \text{ Answer}$$

Q4 $f(\theta) = (2\theta+1)^3 \tan^2\theta$

Sol: $f'(\theta) = (2\theta+1)^3 \frac{d}{d\theta}(\tan^2\theta) + \tan^2\theta \frac{d}{d\theta}(2\theta+1)^3$

$$f'(\theta) = (2\theta+1)^3\left(2\tan\theta \cdot \frac{d}{d\theta}(\tan\theta)\right) + \tan^2\theta \cdot \left(3(2\theta+1)^2 \cdot \frac{d}{d\theta}(2\theta+1)\right)$$

$$f'(\theta) = 2(2\theta+1)^3 \tan\theta \sec^2\theta + \tan^2\theta\left(3(2\theta+1)^2 \cdot 2\right)$$

$$f'(\theta) = 2(2\theta+1)^3 \tan\theta \sec^2\theta + 6\tan^2\theta(2\theta+1)^2$$

$$f'(\theta) = 2(2\theta+1)^2 \tan\theta\left[(2\theta+1)\sec^2\theta + 3\tan\theta\right] \text{ Answer}$$

Q5 $y = \sin 2x \cos 3x$

Sol: $\frac{dy}{dx} = \sin 2x \cdot \frac{d}{dx}(\cos 3x) + \cos 3x \cdot \frac{d}{dx}(\sin 2x)$

$$\frac{dy}{dx} = \sin 2x\left(-\sin 3x \frac{d}{dx}(3x)\right) + \cos 3x \cdot \left(\cos 2x \cdot \frac{d}{dx}(2x)\right)$$

$$\boxed{\frac{dy}{dx} = -3\sin 2x \sin 3x + 2\cos 3x \cos 2x} \text{ Answer}$$

Q6 $f(x) = (\sec 4x + \tan 2x)^5$

Sol: $f'(x) = 5(\sec 4x + \tan 2x)^4 \cdot \frac{d}{dx}(\sec 4x + \tan 2x)$

$$f'(x) = 5(\sec 4x + \tan 2x)^4\left[\sec 4x \tan 4x \cdot \frac{d}{dx}(4x) + \sec^2 2x \frac{d}{dx}(2x)\right.$$

$$f'(x) = 5(\sec 4x + \tan 2x)^4\left[4\sec 4x \tan 4x + 2\sec^2 2x\right]$$

Answer

Q7 $h(t) = \dfrac{t + \sin 4t}{10 + \cos 3t}$

Sol:- $h'(t) = \dfrac{(10+\cos 3t)\frac{d}{dt}(t+\sin 4t) - (t+\sin 4t)\frac{d}{dt}(10+\cos 3t)}{(10+\cos 3t)^2}$

$h'(t) = (10+\cos 3t)\left(1+\cos 4t \cdot \frac{d}{dt}(4t)\right) - (t+\sin 4t)\left(0 - \sin 3t \frac{d}{dt}(3t)\right)$

$h'(t) = \dfrac{(10+\cos 3t)(1+4\cos 4t) + (t+\sin 4t)(3\sin 3t)}{(10+\cos 3t)^2}$ Answer

Q8 $f(x) = \tan\left(\cos \frac{x}{2}\right)$ IMPORTANT

Sol $f'(x) = \sec^2\left(\cos\frac{x}{2}\right)\frac{d}{dx}\left(\cos\frac{x}{2}\right)$

$f'(x) = \sec^2\left(\cos\frac{x}{2}\right)\cdot\left(-\sin\frac{x}{2}\cdot\frac{d}{dx}\left(\frac{x}{2}\right)\right)$

$\boxed{f'(x) = -\frac{1}{2}\sec^2\left(\cos\frac{x}{2}\right)\cdot \sin\frac{x}{2}\,(1)}$ Answer

Q9 $4x^2 + y^2 = 8$

Sol. Diff w.r.t "x"

$4(2x) + 2y\frac{dy}{dx} = 0$

$2y\frac{dy}{dx} = -8x$

$\frac{dy}{dx} = \frac{-8x}{2y}$

$\boxed{\frac{dy}{dx} = \frac{-4x}{y}}$

10 $x + xy - y^2 - 20 = 0$

Sol: Diff w.r.t 'x'

$1 + \left[x\cdot\frac{dy}{dx} + y\frac{d}{dx}(x)\right] - 2y\frac{dy}{dx} = 0$

$1 + x\frac{dy}{dx} + y - 2y\frac{dy}{dx} = 0$

$\frac{dy}{dx}(x - 2y) = -1 - y$

$\frac{dy}{dx} = \frac{-1-y}{x-2y} \Rightarrow \frac{-(1+y)}{-(2y-x)}$

$\boxed{\frac{dy}{dx} = \frac{y+1}{2y-x}}$ A

(11) $y^4 - y^2 = 10x - 3$

Sol. Diff w.r.t "x":

$$4y^3\frac{dy}{dx} - 2y\frac{d(y)}{dx} = 10(1) - 0$$

$$\frac{dy}{dx}\left[4y^3 - 2y\right] = 10$$

$$\frac{dy}{dx} = \frac{10}{4y^3 - 2y}$$

$$\frac{dy}{dx} = \frac{\cancel{10}\,5}{2y(2y^2-1)}$$

$$\boxed{\frac{dy}{dx} = \frac{5}{y(2y^2-1)}}$$

(12) $x^3y^2 = 2x^2 + y^2$

Sol Diff w.r.t x

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

$$x^3\left(2y\frac{dy}{dx}\right) + y^2(3x^2) = 4x + 2y\frac{dy}{dx}$$

$$2x^3y\frac{dy}{dx} - 2y\frac{dy}{dx} = 4x - 3x^2y^2$$

$$\frac{dy}{dx}(2x^3y - 2y) = 4x - 3x^2y^2$$

$$\boxed{\frac{dy}{dx} = \frac{4x - 3x^2y^2}{2x^3y - 2y}}$$

Q13 $xy = \sin x + y$

Sol? Diff w.r.t x

$$x\frac{dy}{dx} + y(1) = \cos x + \frac{dy}{dx}$$

$$x\frac{dy}{dx} - \frac{dy}{dx} = \cos x - y$$

$$\frac{dy}{dx}(x-1) = \cos x - y$$

$$\boxed{\frac{dy}{dx} = \frac{\cos x - y}{x-1}}$$ Answer

Q14 $x + y = \cos(xy)$

Diff w.r.t x

$$1 + \frac{dy}{dx} = -\sin(xy)\frac{d}{dx}(xy)$$

$$1 + \frac{dy}{dx} = -\sin xy\left[x\frac{dy}{dx} + y(1)\right]$$

$$1 + \frac{dy}{dx} = -x\sin xy\frac{dy}{dx} - y\sin(xy)$$

$$\frac{dy}{dx} + x\sin(xy)\frac{dy}{dx} = -1 - y\sin(xy)$$

$$\frac{dy}{dx} + x\sin(xy)\frac{dy}{dx} = -1 - y\sin(xy)$$

$$\frac{dy}{dx}\left(1 + x\sin(xy)\right) = -1 - y\sin(xy)$$

$$\boxed{\frac{dy}{dx} = \frac{-(1 + y\sin(xy))}{1 + x\sin(xy)}}$$

Q15 $x\sin y - y\cos x = 1$

Sol Diff w.r.t 'x'

$$\left[x\frac{d}{dx}(\sin y)+\sin y(1)\right]-\left[y\frac{d}{dx}(\cos x)+\cos\frac{dy}{dx}\right]=0$$

$$x\cos y\frac{dy}{dx}+\sin y - y(-\sin x) - \cos x\frac{dy}{dx}=0$$

$$\frac{dy}{dx}\left[x\cos y-\cos x\right] = -\sin y - y\sin x$$

$$\frac{dy}{dx} = \cancel{-}\left(\frac{\sin y+y\sin x}{\cancel{-}(\cos x - x\cos y)}\right)$$ Answer.

Q16 $\sin y = y\cos 2x$

Diff w.r.t 'x'

$$\cos y\frac{dy}{dx} = y\left(-\sin 2x\cdot\frac{d}{dx}(2x)\right) + \cos 2x\frac{d}{dx}(y)$$

$$\cos y \frac{dy}{dx} = -2y\sin 2x + \cos 2x\frac{dy}{dx}$$

$$\cos y\frac{dy}{dx} - \cos 2x\frac{dy}{dx} = -2y\sin 2x$$

$$\frac{dy}{dx}\left[\cos y - \cos 2x\right] = -2y\sin 2x$$

$$\frac{dy}{dx} = \frac{+2y\sin 2x}{\cos 2x - \cos y}$$ Ans

Q17 $y = x^3e^{5x}$

Diff w.r.t 'x'

$$\frac{dy}{dx} = x^3\frac{d}{dx}(e^{5x}) + e^{5x}\cdot\frac{d}{dx}(x^3)$$

$$\frac{dy}{dx} = x^3e^{5x}\frac{d}{dx}(5x)+e^{5x}(3x^2) \Rightarrow \boxed{\frac{dy}{dx} = 5x^3e^{5x}(1)+3x^2e^{5x}}$$

Q18) $y = e^{4x}(1+\ln x)$

Sol: Diff w.r.t 'x'

$$\frac{dy}{dx} = e^{x}\frac{d}{dx}(1+\ln x) + (1+\ln x)\frac{d}{dx}(e^{4x})$$

$$\frac{dy}{dx} = e^{x}\left(\frac{1}{x}\right) + (1+\ln x)(e^{4x})\frac{d}{dx}(4x)$$

$$\boxed{\frac{dy}{dx} = x^{-1}e^{x} + 4(1+\ln x)e^{4x}}$$ Ans

Q19) $y = \dfrac{e^{2x}}{e^{-2x}+1}$

Sol: Diff w.r.t 'x'

$$\frac{dy}{dx} = \frac{(e^{-2x}+1)\frac{d}{dx}(e^{2x}) - e^{2x}\frac{d}{dx}(e^{-2x}+1)}{(e^{-2x}+1)^2}$$

$$\frac{dy}{dx} = \frac{(e^{-2x}+1)\cdot e^{2x}\frac{d}{dx}(2x) - e^{2x}\left(e^{-2x}\cdot\frac{d}{dx}(-2x)+0\right)}{(e^{-2x}+1)^2}$$

$$\frac{dy}{dx} = \frac{2(e^{-2x}+1)e^{2x} + 2e^{2x}\cdot e^{-2x}}{(e^{-2x}+1)^2}$$

$$\boxed{\frac{dy}{dx} = \frac{2(e^{-2x}+1)e^{2x}+2}{(e^{-2x}+1)^2}}$$ Ans

Q20 $y = \ln(e^{x}+e^{-x})$

Sol: Diff w.r.t x

$$\frac{dy}{dx} = \left(\frac{1}{e^{x}+e^{-x}}\right)\frac{d}{dx}(e^{x}+e^{-x})$$

$$\frac{dy}{dx} = \frac{1}{e^{x}-e^{-x}}\left(e^{x}(1)+e^{-x}(-1)\right)$$

$$\boxed{\frac{dy}{dx} = \frac{e^{x}-e^{-x}}{e^{x}+e^{-x}}}$$ A

(21) $y = \ln\left(x+\sqrt{x^2+1}\right)$

Sol $\frac{dy}{dx} = \frac{1}{x+\sqrt{x^2+1}} \cdot \frac{d}{dx}\left(x+(x^2+1)^{1/2}\right)$

$$\frac{dy}{dx} = \frac{1}{x+\sqrt{x^2+1}} \cdot \left[1+\frac{1}{2}(x^2+1)^{-1/2}\frac{d}{dx}(x^2+1)\right]$$

$$\frac{dy}{dx} = \frac{1}{x+\sqrt{x^2+1}}\left[1+\frac{1}{2\sqrt{x^2+1}}(2x+0)\right]$$

$$\frac{dy}{dx} = \frac{1}{x\sqrt{x^2+1}}\left[1+\frac{x}{\sqrt{x^2+1}}\right]$$ Answer

(22) $y = e^{-3x}\cos x$

Sol Diff w.r.t 'x'.

$$\frac{dy}{dx} = e^{-3x}\cdot\frac{d}{dx}(\cos x)+\cos x\frac{d}{dx}(e^{-3x})$$

$$\frac{dy}{dx} = e^{-3x}(-\sin x)+\cos x\left(e^{-3x}\cdot\frac{d}{dx}(-3x)\right)$$

$$\frac{dy}{dx} = -\sin x\, e^{-3x} - 3\cos x\cdot e^{-3x}\cdot(1)$$

$$\frac{dy}{dx} = -e^{-3x}(\sin x+3\cos x)$$ Answer

(Q23) $x = t+\frac{1}{t}$, $y = t+1$

Diff w.r.t 't'.

$$\frac{d}{dt}(x) = \frac{d}{dt}(t)+\frac{d}{dt}(t^{-1})$$

$$\frac{dx}{dt} = 1+(-1t^{-2})$$

$$\frac{dx}{dt} = 1-\frac{1}{t^2}$$

$$\frac{dx}{dt} = \frac{t^2-1}{t^2}$$

$$\boxed{\frac{dx}{dt} = \frac{t^2-1}{t^2}}$$

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

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

By chain rule

$$\frac{dy}{dx} = \frac{dy}{dt} \cdot \frac{dt}{dx}$$

$$\frac{dy}{dx} = 1\left(\frac{t^2}{t^2-1}\right)$$

$$\boxed{\frac{dy}{dx} = \frac{t^2}{t^2-1}}$$ Ans

(Q) 24) $x = t^2 + \frac{1}{t^2}$, $y = t - \frac{1}{t}$

$$\frac{d}{dt}(x) = \frac{d}{dt}(t^2) + \frac{d}{dt}(t^{-2})$$

$$\frac{dx}{dt} = 2t + (-2t^{-3})$$

$$\frac{dx}{dt} = 2t - \frac{2}{t^3}$$

$$\boxed{\frac{dx}{dt} = \frac{2t^4 - 2}{t^2}}$$

$y = t - \frac{1}{t}$

$$\frac{dy}{dt} = \frac{d}{dt}(t) - \frac{d}{dt}(t^{-1})$$

$$\frac{dy}{dt} = 1 - (-1 \cdot t^{-2})$$

$$\frac{dy}{dt} = 1 + \frac{1}{t^2}$$

$$\boxed{\frac{dy}{dt} = \frac{t^2+1}{t^2}}$$

By chain rule

$$\frac{dy}{dx} = \frac{dy}{dt} \cdot \frac{dt}{dx}$$

$$\frac{dy}{dx} = \left(\frac{t^2+1}{t^2}\right)\left(\frac{t^3}{2t^4-2}\right)$$

$$\frac{dy}{dx} = \frac{t(t^2+1)}{2(t^4-1)}$$

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

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

$$\boxed{\frac{dy}{dx} = \frac{t}{2(t^2-1)}}$$ Ans

IMP

Q25) $x = \frac{\theta^2 - 1}{\theta^2 + 1}$, $y = \frac{\theta - 1}{\theta + 1}$

Diff w.r.t 'θ'.

$$\frac{dx}{d\theta} = \frac{(\theta^2+1)\frac{d}{d\theta}(\theta^2-1) - (\theta^2-1)\frac{d}{d\theta}(\theta^2+1)}{(\theta^2+1)^2}$$

$$\frac{dx}{d\theta} = \frac{(\theta^2+1)(2\theta) - (\theta^2-1)(2\theta)}{(\theta^2+1)^2}$$

$$= \frac{2\theta[\cancel{\theta^2}+1-\cancel{\theta^2}+1)}{(\theta^2+1)^2}$$

$$\boxed{\frac{dx}{d\theta} = \frac{4\theta}{(\theta^2+1)^2}}$$

$$\frac{dy}{d\theta} = \frac{(\theta+1)\frac{d}{d\theta}(\theta-1) - (\theta-1)\frac{d}{d\theta}(\theta+1)}{(\theta+1)^2}$$

$$\frac{dy}{d\theta} = \frac{(\theta+1)(1) - (\theta-1)(1)}{(\theta+1)^2}$$

$$\frac{dy}{d\theta} = \frac{\cancel{\theta}+1-\cancel{\theta}+1}{(\theta+1)^2}$$

$$\boxed{\frac{dy}{d\theta} = \frac{2}{(\theta+1)^2}}$$

By chain Rule

$$\frac{dy}{dx} = \frac{dy}{d\theta} \cdot \frac{d\theta}{dx} = \frac{2}{(\theta+1)^2} \cdot \frac{(\theta^2+1)^2}{4\theta}$$

$$\frac{dy}{dx} = \frac{(\theta^2+1)^2}{2\theta(\theta+1)^2}$$ Answer.

Q26 $x = \sin 2\theta$, $y = \cos 4\theta$

Sol: $\frac{dx}{d\theta} = \cos 2\theta \cdot \frac{d}{dx}(2\theta)$

$$\boxed{\frac{dx}{d\theta} = 2\cos 2\theta (1)}$$

$\frac{dy}{d\theta} = -\sin 4\theta \cdot \frac{d}{d\theta}(4\theta)$

$\frac{dy}{d\theta} = -4\sin 4\theta \cdot (1)$

By chain Rule: $\frac{dy}{dx} = \frac{dy}{d\theta} \cdot \frac{d\theta}{dx}$

$\frac{dy}{dx} = (-4\sin 4\theta) \frac{1}{2\cos 2\theta}$

$$\boxed{\frac{dy}{dx} = \frac{-2\sin 4\theta}{\cos 2\theta}}$$ Answer

Q27 $y = x^2+1$

$\Delta y = ?$

$\Delta y = f(x+\Delta x) - f(x)$

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

$f(x+\Delta x) = (x+\Delta x)^2 + 1$

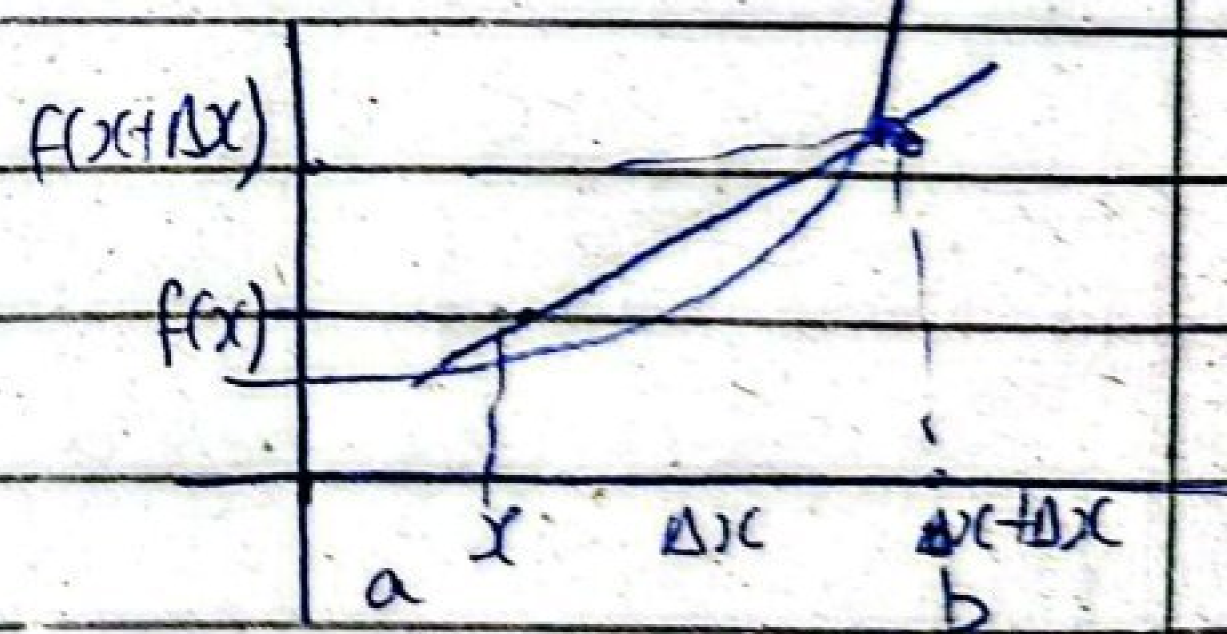
$$\boxed{f(x+\Delta x) = x^2 + \Delta x^2 + 2x\Delta x + 1}$$

$\Delta y = \cancel{x^2} + \Delta x^2 + 2x\Delta x + \cancel{1} - \cancel{x^2} - \cancel{1}$

$$\boxed{\Delta y = 2x\Delta x + (\Delta x)^2}$$

$dy = ?$

$dy = f'(x)\Delta x \quad \because \Delta x \approx dx$



slope = $\frac{\text{vertical change}}{\text{Horizontal change}}$

$\Delta y = f(x+\Delta x) - f(x)$

$\Delta x \approx dx$

$\frac{dy}{dx} = f'(x)$

$dy = f'(x)dx$

$$\boxed{dy = f'(x)\Delta x}$$

$f(x) = x^2+1$ $\quad \therefore \Delta x \approx dx$

$\boxed{f'(x) = 2x}$

$\boxed{dy = 2x \cdot \Delta x}$ Answer.

It's clearly $(\Delta x)^2$ is difference b/w Δy & dy Answer

Q28. $y = \sin x$

Sol $\Delta y = f(x+\Delta x) - f(x)$

$\boxed{\Delta y = \sin(x+\Delta x) - \sin x}$ Answer

$dy = f'(x)\Delta x$

$f(x) = \sin x$

$f'(x) = \cos x$

$\boxed{dy = \cos x \cdot \Delta x}$ Answer

Q29) $(1.8)^5$

Sol $f(x+\Delta x) = (1.8)^5$

$f(x+\Delta x) = (2-0.2)^5$

$\boxed{f(x) = x^5}$

$x = 2 \quad \Delta x = -0.2$

$f'(x) = 5x^4$

$dy = f'(x)\Delta x = 5x^4 \cdot \Delta x$

$dy = 5(2)^4 \cdot (-0.2) = -16$

$f(x+\Delta x) = f(x) + dy$

$f(x+\Delta x) = x^5 + (-16)$

$(1.8)^5 = 2^5 + (-16)$

$32 - 16$

$\boxed{(1.8)^5 = 16}$ Answer.

$\Delta y = f(x+\Delta x) - f(x)$

$\Delta y + f(x) = f(x+\Delta x)$

for very small vale of x

$\Delta y \approx dy$

$f(x+\Delta x) = f(x) + dy$

$f(x+\Delta x) = f(x) + f'(x)\,dx$

(30) $\sqrt{37}$

Sol+ $f(x+\Delta x) = \sqrt{36+1}$

$f(x) = \sqrt{x}$

$x = 36$, $\Delta x = 1$

$f'(x) = \frac{1}{2}x^{-1/2}$

$f'(36) = \frac{1}{2\sqrt{36}} = \frac{1}{2(6)} = \boxed{\frac{1}{12}}$

$dy = f'(x)\Delta x = \frac{1}{12}(1)$

$f(x+\Delta x) = f(x) + dy$

$f(x+\Delta x) = \sqrt{x} + \frac{1}{12}$

$\sqrt{37} = \sqrt{36} + \frac{1}{12}$

$= 6 + \frac{1}{12}$

$\boxed{\sqrt{37} = 6.0833}$

(31) $\sin 31^\circ$ V.IMP

Sol+

$f(x+\Delta x) = \sin(30^\circ + 1^\circ)$

$f(x) = \sin x$

$f'(x) = \cos x$

$\therefore x = 30$

$x = \frac{\pi}{180}$

$\boxed{x = 0.017}$

$dy = f'(x)\Delta x$

$dy = \cos 30(0.017)$

$dy = \cos 30(0.017)$

$dy = \frac{\sqrt{3}}{2}(0.017)$

$= 0.014722$

$f(x+\Delta x) = f(x) + dy$

$\sin 31^\circ = \sin 30^\circ + 0.01472$

$\sin 31^\circ = 0.51472$ Answer

(Q32) $\tan\left(\frac{\pi}{4} + 0.1\right)$

Sol+ $x = \frac{\pi}{4}$, $\Delta x = 0.1$

$f(x+\Delta x) = \tan(x+\Delta x)$

$f(x) = \tan x$

$f'(x) = \sec^2 x$

$f'\left(\frac{\pi}{4}\right) = \sec^2\left(\frac{\pi}{4}\right) = \frac{1}{\left(\cos\frac{\pi}{4}\right)^2}$

$f'\left(\frac{\pi}{4}\right) = \frac{1}{\left(\frac{1}{\sqrt{2}}\right)^2} = \frac{1}{1/2} = \boxed{2}$

$dy = f'(x)\Delta x = 2(0.1) = \boxed{0.2}$

$f(x+\Delta x) = f(x) + dy$

$\tan\left(\frac{\pi}{4} + 0.1\right) = \tan\frac{\pi}{4} + 0.2 = 1 + 0.2$

$\boxed{\tan\left(\frac{\pi}{4} + 0.1\right) = 1.2}$ Answer