Exercise 9C

4) $y = (5-2x)^3$

when $x = 1$

$y = (5-2)^3 = 27$

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

$$= -6(5-2x)^2$$

when $x = 1$ $\quad \frac{dy}{dx} = -6(3)^2 = -54$

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

$$y - 27 = -54(x-1)$$

$$y - 27 = -54x + 54$$

$$y = -54x + 81$$

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6) $x = y^2 + y$

a) $\frac{dx}{dy} = 2y + 1$

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

b) $x = e^y + 4y$

$$\frac{dx}{dy} = e^y + 4$$

$$\frac{dy}{dx} = \frac{1}{e^y + 4}$$

c)

$$x = \sin 2y$$

$$\frac{dx}{dy} = 2\cos 2y$$

$$\frac{dy}{dx} = \frac{1}{2\cos 2y}$$

d)

$$4x = \ln y + y^3$$

$$x = \frac{1}{4}\ln y + \frac{1}{4}y^3$$

$$\frac{dx}{dy} = \frac{1}{4y} + \frac{3}{4}y^2$$

$$\frac{dx}{dy} = \frac{1 + 3y^3}{4y}$$

$$\frac{dy}{dx} = \frac{4y}{1 + 3y^3}$$

8) $x = y^{\frac{1}{2}} + y^{-\frac{1}{2}}$

$$\frac{dx}{dy} = \frac{1}{2}y^{-\frac{1}{2}} - \frac{1}{2}y^{-3/2}$$

$$\frac{dx}{dy} = \frac{1}{2}y^{-3/2}(y - 1)$$

$$\frac{dx}{dy} = \frac{y-1}{2y^{3/2}}$$

$$\frac{dy}{dx} = \frac{2y^{3/2}}{y-1}$$

At $(\frac{5}{2}, 4)$ $\quad \frac{dy}{dx} = \frac{2(4)^{3/2}}{4-1}$

$$= \frac{16}{3}$$

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10) $x = 4\cos 2y$

when $y = \frac{\pi}{6}$ $\quad x = 4 \times \cos\frac{\pi}{3}$

$$x = 4 \times \frac{1}{2}$$

$$x = 2$$

$\therefore (2, \frac{\pi}{6})$ is on curve

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

$$\frac{dy}{dx} = -\frac{1}{8\sin 2y}$$

At Q, $y = \frac{\pi}{6}$ $\quad \frac{dy}{dx} = -\frac{1}{8\sin\frac{\pi}{3}}$

$$= -\frac{1}{8\times\frac{\sqrt{3}}{2}}$$

$$= -\frac{1}{4\sqrt{3}}$$

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c) Normal has gradient $4\sqrt{3}$

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

$$y - \frac{\pi}{6} = 4\sqrt{3}(x - 2)$$

$$y - \frac{\pi}{6} = 4\sqrt{3}x - 8\sqrt{3}$$

$$6y - \pi = 24\sqrt{3}x - 48\sqrt{3}$$

$$0 = 24\sqrt{3}x - 6y + (\pi - 48\sqrt{3})$$

Exercise Q3, Q5, Q7, Q9

Degrees	Radians
360	2π
180	π
90	$\frac{\pi}{2}$
60	$\frac{\pi}{3}$
45	$\frac{\pi}{4}$
30	$\frac{\pi}{3}$

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3) $y = \frac{1}{(4x+1)^2} = (4x+1)^{-2}$

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

$$= -8(4x+1)^{-3}$$

$$= -\frac{8}{(4x+1)^3}$$

At $(\frac{1}{4}, \frac{1}{4})$ $\quad \frac{dy}{dx} = -\frac{8}{(4(\frac{1}{4})+1)^3} = -\frac{8}{2^3}$

$$= -1$$

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5) $y = (1+\ln 4x)^{3/2}$

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

$$= \frac{3}{2}(1+\ln 4x)^{\frac{1}{2}}\left(\frac{1}{x}\right)$$

when $x = \frac{1}{4}e^3$

$$\frac{dy}{dx} = \frac{3}{2}(1+\ln e^3)\frac{1}{(\frac{1}{4}e^3)}$$

$$\frac{dy}{dx} = \frac{3}{2}(1+3\ln e)\frac{4}{e^3}$$

$$= \frac{3}{2}(1+3)\frac{4}{e^3}$$

$$= \frac{24}{e^3}$$