

11(a)	Substitute 4 to obtain gradient of curve is $\frac{1}{10}$
	Attempt equation of normal using $(4, 3)$ and $-\frac{1}{m}$ for their gradient
	$y = -10x + 43$
11(b)	$\{-16x^{-3}\}\{+40(2x-3)^{-3}\}$
	Substitute 4 to obtain $\frac{7}{100}$
11(c)	$[y =]\{-8x^{-1}\}\{+5(2x-3)^{-1}\}[+c]$
	Substitute $x = 4, y = 3$ in an integrated expression to find value of c
	Obtain $3 = -2 + 1 + c$ and hence $y = -8x^{-1} + 5(2x-3)^{-1} + 4$
	Substitute $x = -1$ to obtain $q = 11$

4(a)	$[k=]4$
4(b)	$\left\{\frac{k}{4}x^4\right\} + \left\{\frac{2x^{-2+1}}{-2+1}\right\} [+c]$
	$20 = \frac{\text{their } k}{4} \times 2^4 - \frac{2}{2} + c$
	$c = 5$
	$[t=]4$
5(a)	$\left[\frac{dy}{dx} = \right] 2x^{-\frac{1}{2}} - 1$
	$2x^{-\frac{1}{2}} - 1 = 0 \Rightarrow x^{\frac{1}{2}} = 2$
	$[a=]4$
	Alternative Method for Question 5(a):
	$y = 4\sqrt{x} - (\sqrt{x})^2$
	$\text{Max at } \sqrt{x} = \frac{-b}{2a} = \frac{-4}{-2} = 2$ or $-(\sqrt{x} - 2)^2 + 4 \Rightarrow x^{\frac{1}{2}} = 2$
	$[a=]4$

5(b)

$$[x = \text{or } b =] 16$$

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

$$[\text{Area} =] \left(\frac{8}{3} \times 16^{\frac{3}{2}} - \frac{1}{2} \times 16^2 \right) - \left(\frac{8}{3} \times 4^{\frac{3}{2}} - \frac{1}{2} \times 4^2 \right)$$

$$\left\{ = \frac{128}{3} - \frac{40}{3} \right\} = \frac{88}{3} \text{ or } 29\frac{1}{3}$$

9(a)	$\frac{4 \times 3 \times (-2)}{(3x-6)^3} + \frac{1 \times 3 \times (-3)}{(3x-6)^4}$ or $4 \times 3 \times (-2)(3x-6)^{-3} + 1 \times 3 \times (-3)(3x-6)^{-4}$
	Decreasing.
9(b)	f^{-1} exists because f is a decreasing function Or f^{-1} exists because it is one-to-one, or passes the horizontal line test.
9(c)	$g(x) > 4a - 3$
9(d)	Either $4a - 3 > 2$ allow with x or a or $\geq$
	$a > \frac{5}{4}$ or $a \geq \frac{5}{4}$ oe
	Or $3 \times (4a - 3) - 6 > 0$ allow with x or a or $\geq$
	$a > \frac{5}{4}$ or $a \geq \frac{5}{4}$ oe

2(a)	$[\text{Gradient of tangent}] = 4(2 \times 4 - 5)^3 - 9 \times 4^{\frac{1}{2}} [= 90]$
	$[\text{Gradient of normal}] = -\frac{1}{90}$
2(b)	$[y] = \left\{ \frac{1}{2}(2x - 5)^4 \right\} \left\{ -6x^{\frac{3}{2}} \right\} [+c]$
	$-\frac{11}{2} = \frac{1}{2} \times (2 \times 4 - 5)^4 - 6 \times 4^{\frac{3}{2}} + c$
	$y = \frac{1}{2}(2x - 5)^4 - 6x^{\frac{3}{2}} + 2$
7(a)	$\left[\frac{dy}{dx} = \right] 8x - \frac{18}{x^3}$
	$\text{At } x = 2, \frac{dy}{dx} = \frac{55}{4}$
	$\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx} \Rightarrow \frac{55}{4} = -5 \times \frac{dt}{dx}$
	$\left[\frac{dx}{dt} = \right] -\frac{4}{11}$

7(b)

$$8x - \frac{18}{x^3} = 0 \quad \left[\Rightarrow x^4 = \frac{9}{4} \right]$$

$$x = \pm \sqrt{\frac{3}{2}} \quad \text{or} \quad \pm \frac{\sqrt{6}}{2}$$

$y = 4$ (for both)

$$\left[\frac{d^2 y}{dx^2} \right] = 8 + \frac{54}{x^4}$$

So both are minima

4(a)	$\left[\frac{dy}{dx} \right] = \frac{3}{2}ax^{\frac{1}{2}} - 12$
	$\left[\frac{dy}{dt} = \frac{dy}{dx} \times \frac{dx}{dt} = \right] \left(\frac{3}{2}a \times 9^{\frac{1}{2}} - 12 \right) \times 5$
	$\left[\frac{dy}{dt} = \right] 5 \left(\frac{9}{2}a - 12 \right) \text{ or } \frac{45}{2}a - 60 \text{ or } 22.5a - 60 \text{ or } \frac{45a - 120}{2}$ or $\frac{15}{2}(3a - 8)$
4(b)	$\frac{3}{2}a \times \left(\frac{1}{4} \right)^{\frac{1}{2}} - 12 = 0$
	$\Rightarrow a = 16$
9(a)	$\left[\frac{dy}{dx} = \right] \frac{-24x^{-2}}{-2} \left[= \frac{12}{x^2} \right] [+c]$
	$\frac{12}{(-2)^2} + c = 0 \quad [\Rightarrow c = -3]$
	$\left[\frac{dy}{dx} = \right] \frac{12}{x^2} - 3 \text{ or } 12x^{-2} - 3$

9(b)	$\left[\frac{12}{x^2} - 3 = 0 \Rightarrow x^2 = 4 \Rightarrow x = \pm 2 \Rightarrow \right] x = 2$
	$\left[\frac{d^2 y}{dx^2} = \right] - \frac{24}{(2)^3} \text{ or } -3 \text{ or } < 0 \Rightarrow \text{maximum}$
9(c)	$[y =] -12x^{-1} + \text{their } cx \left[= -\frac{12}{x} - 3x \right] [+d]$
	$19 = -\frac{12}{-2} - 3 \times (-2) + d \quad [\Rightarrow d = 7]$
	$y = -\frac{12}{x} - 3x + 7$

9(d)

$$\frac{12}{x^2} - 3 = -\frac{9}{4} \Rightarrow \frac{12}{x^2} = \frac{3}{4} \Rightarrow x = \dots \left[\Rightarrow x^2 = 16 \Rightarrow x = 4, y = -8 \right]$$

$$\text{Gradient of normal} = \frac{4}{9}$$

$$\frac{y+8}{(x-4)} = \frac{4}{9}$$

$$4x - 9y - 88 = 0$$