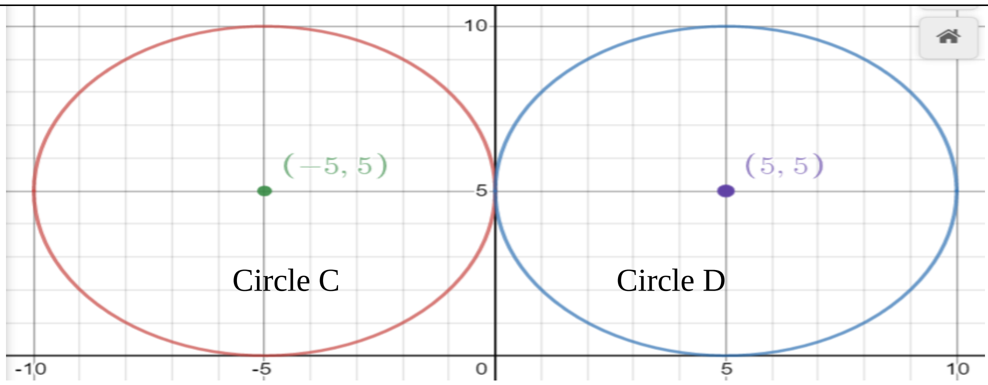
No.	SOLUTION
1a(i)	$a = P\left(1+\frac{q}{100}\right), r = \left(1+\frac{q}{100}\right)$ $T_n = ar^{n-1}$ $= P\left(1+\frac{q}{100}\right)^n$ Solve for n: $P\left(1+\frac{q}{100}\right)^{15} = 2P$ $\frac{q}{100} = 2^{\frac{1}{15}} - 1$ $q = 4.73\%$
a(ii)	$10,000\left(1+\frac{3}{100}\right)^n = 30,000$ $\left(1+\frac{3}{100}\right)^n = 3$ $n = \frac{\log 3}{\log 1.03}$ $= 37.17$ It takes 38 years to reach more than \$30,000
1(b) (i)	$x^2 + 10x + y^2 - 10y + 25 = 0$ $(x+5)^2 - 5^2 + (y-5)^2 - 5^2 + 25 = 0$ $(x+5)^2 + (y-5)^2 = 25$ Centre $(-5,5)$, radius = 5

No.	SOLUTION
(ii)	
(iii)	Distance = 10 units

No.	SOLUTION
2a	$x = 2t + \ln t$, $\quad y = t + 4$ $\frac{dx}{dt} = 2 + \frac{1}{t}$ $\frac{dy}{dt} = 1$ $\frac{dy}{dx} = \frac{dy}{dt} \div \frac{dx}{dt}$ $= (1) \div \left(2 + \frac{1}{t}\right)$ $= (1) \div \left(\frac{2t+1}{t}\right)$ $= \frac{t}{2t+1}$ (shown)
(b)	$t = 1, \frac{dy}{dx} = \frac{1}{3}$ $x = 2, y = 5$ $\frac{y-5}{x-2} = \frac{1}{3} \Rightarrow 3y = x + 13$

No.	SOLUTION
2(c)	$\dfrac{d^2y}{dx^2}=\dfrac{\dfrac{d}{dt}\left(\dfrac{dy}{dx}\right)}{\dfrac{dx}{dt}}=\dfrac{\dfrac{d}{dt}\left(\dfrac{t}{2t+1}\right)}{2+\dfrac{1}{t}}$ $=\dfrac{\dfrac{1}{(2t+1)^2}}{\dfrac{2t+1}{t}}$ $=\dfrac{t}{(2t+1)^3}$
2d	$x-2y=8$ $2t+\ln t-2(t+4)=8$ $\ln t=16$ $t=e^{16}$

No.	SOLUTION
3a (i)	$f(x)=\dfrac{1}{2-\sqrt{x-3}}$ $g(x)=4+\sin x$ $D_f=\{x:x\geq 3 \text{ and } x\neq 7\}$ $=[3,7)\cup(7,+\infty)$
(ii)	$D_g=(-\infty,\infty)$ $R_g=\{g(x):3\leq g(x)\leq 5\}$ $=[3,5]$
(iii)	$(g\circ f)(x)=g\left(\dfrac{1}{2-\sqrt{x-3}}\right)$ $=4+\sin\left(\dfrac{1}{2-\sqrt{x-3}}\right)$ $(g\circ f)(3)=4+\sin\left(\dfrac{1}{2}\right)$ $=4.48$

No.	SOLUTION
3(b)(i)	$f(x) = ax + b$ $f(1) = a + b = 2$ $a = 2 - b \ldots (1)$ $f^{-1}(x) = \dfrac{x-b}{a}$ $\dfrac{x-b}{a} = ax + b$ at $x = 4$ $\dfrac{4-b}{a} = 4a + b$ $4 - b = 4a^2 + ab \ldots (2)$ Subst (1) into (2) $4 - b = 4(2-b)^2 + (2-b)b$ $= 4(4 - 4b + b^2) + 2b - b^2$ $4 - b = 16 - 16b + 4b^2 + 2b - b^2$ $0 = 3b^2 - 13b + 12$ $b = 3$ or $\dfrac{4}{3}$ $a = 2 - 3$ $= -1$ (N. A.) $a = 2 - \dfrac{4}{3}$ $= \dfrac{2}{3}$ Hence, $a = \dfrac{2}{3}$ and $b = \dfrac{4}{3}$
3(b)(ii)	$f(x) = \dfrac{2}{3}x + \dfrac{4}{3}$ $f(6) = 5\dfrac{1}{3}$ $R_f = \left[\dfrac{4}{3}, 5\dfrac{1}{3}\right]$

No.	SOLUTION
4a.	$y=\sin^3(2x)$ $\frac{dy}{dx}=3\sin^2(2x)\cos(2x)2$ $x=1, \frac{dy}{dx}=6\sin^2(2)\cos(2)$ $=-2.06$
(b)	$y=0, x=3 \Rightarrow P(3,0)$ $x=0, y=6 \Rightarrow Q(0,6)$ $y=\frac{6-2x}{x+1}$ $\frac{dy}{dx}=\frac{(x+1)(-2)-(6-2x)}{(x+1)^2}$ $=\frac{-8}{(x+1)^2}$ $x=3, \frac{dy}{dx}=\frac{-8}{(3+1)^2}=-\frac{1}{2}$ $M_{normal}=2$ $\frac{y-0}{x-3}=2$ $y=2x-6$ $x=0, y=-6 \Rightarrow R(0,-6)$ $QR=6-(-6)$ $=12$ units

No.	SOLUTION
5 a(i)	$y = 20x(x+1)^4$ $\frac{dy}{dx} = 20x4(x+1)^3 + (x+1)^4 20$ $= (x+1)^3[80x + 20x + 20]$ $= (x+1)^3(100x+20)$

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

$$(x+1)^3(100x+20) = 0$$

$$x = -1 \text{ or } x = -\frac{1}{5}$$

	x^-	x	x^+
Gradient ($\frac{dy}{dx}$) For x = -1	+	0	-
Gradient ($\frac{dy}{dx}$) For x = -0.2	-	0	+

$x = -1, y = 0, \max(-1, 0)$

$x = -0.2, y = -1.64, \min(-0.2, -1.64)$

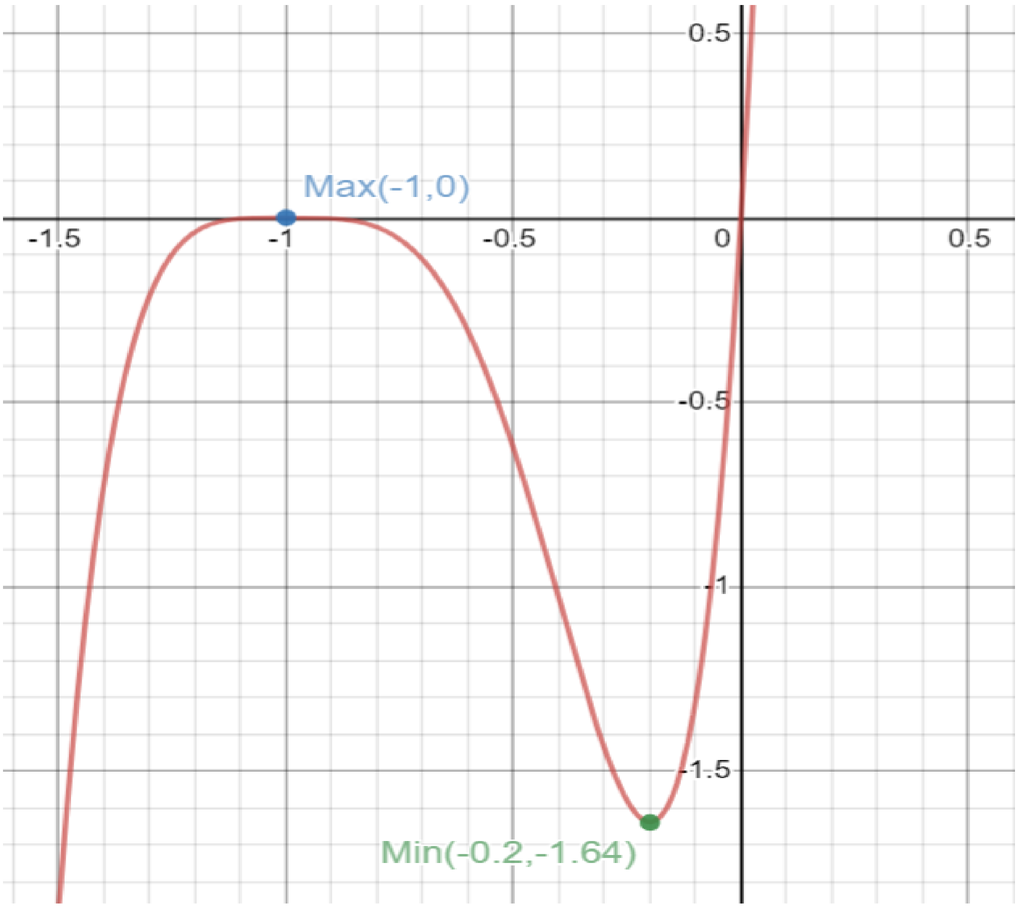
Note, cant use 2nd derivative test for x=-1

$$\frac{d^2y}{dx^2} = (x+1)^3 100 + (100x+20)3(x+1)^2$$

$$= (x+1)^2[100x + 100 + 300x + 60]$$

$$= (x+1)^2(400x+160)$$

$x = -1, \frac{d^2y}{dx^2} = 0$ (not conclusive hence use 1st derivative test)

No.	SOLUTION
5a (ii)	
5(b) (i)	$f(x)=3x^2+x+1$ $f(x+\Delta x)-f(x)=3(x+\Delta x)^2+x+\Delta x+1-\left[3x^2+x+1\right]$ $=3\left(x^2+2x\Delta x+\Delta x^2\right)+x+\Delta x+1-3x^2-x-1$ $=3x^2+6x\Delta x+3\Delta x^2+\Delta x-3x^2$ $=6x\Delta x+3\Delta x^2+\Delta x$
(ii)	$\lim\limits_{\Delta x\to 0}\dfrac{f(x+\Delta x)-f(x)}{\Delta x}=\lim\limits_{\Delta x\to 0}\dfrac{6x\Delta x+3\Delta x^2+\Delta x}{\Delta x}$ $=\lim\limits_{\Delta x\to 0}(6x+3\Delta x+1)$ $=6x+1$