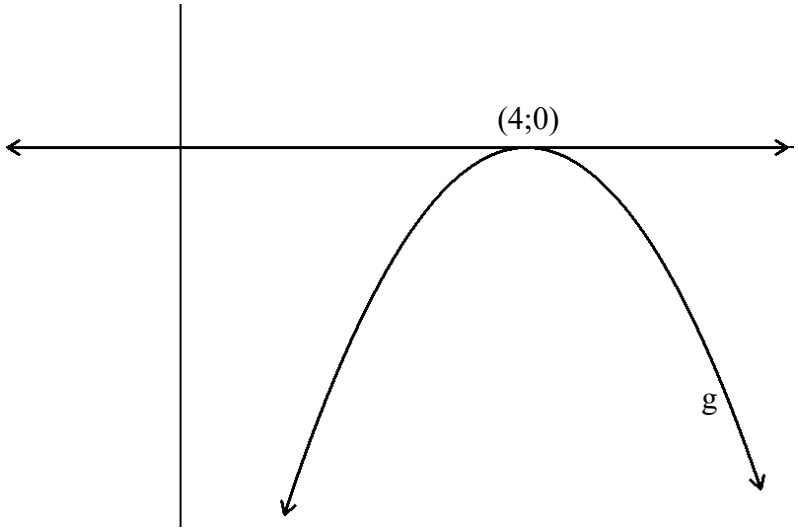
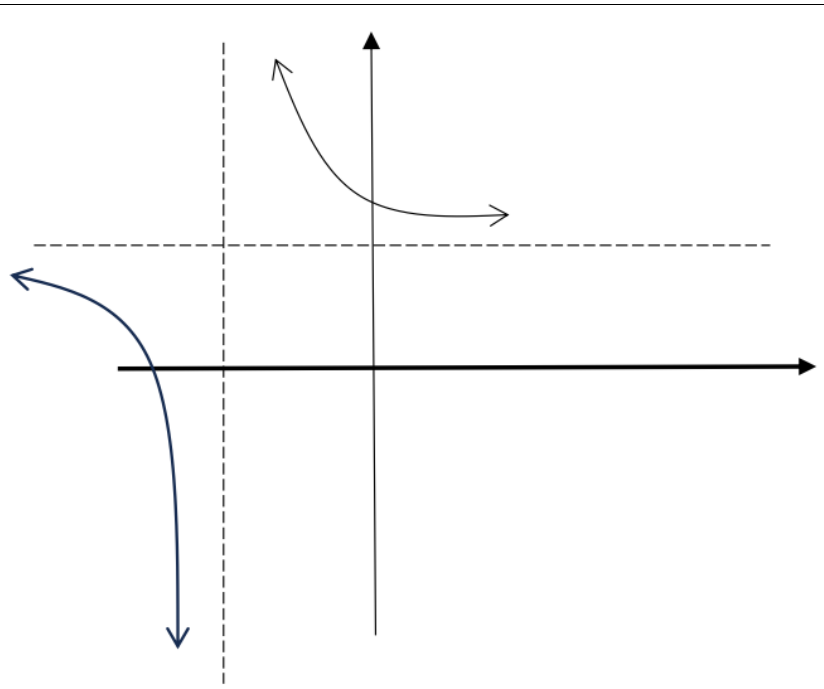
QUESTION 5

5.1	$B(2;1)$	✓ $B(2;1)$ (1)
5.2	$x=2$	✓ substitution (1)
5.3	$y=-x^2+4x-3$ $x^2-4x+3=0$ $(x-1)(x-3)=0$ $x=1$ or $x=3$ $C(3;0)$ and $A(1;0)$	✓ factors ✓ $A(3;0)$ ✓ $B(1;0)$ (3)
5.4	$x\leq 1$ or $x\geq 3$	✓ $x\leq 1$ ✓ $x\geq 3$ (2)
5.5	average gradient $=\frac{1-0}{2-3}=1$ $=1$	✓ substitution ✓ answer (2)
5.6	$g(x)=-(x-4)^2$ 	✓ $g(x)=-(x-4)^2$ ✓ shape ✓ intercepts (3)
		[14]

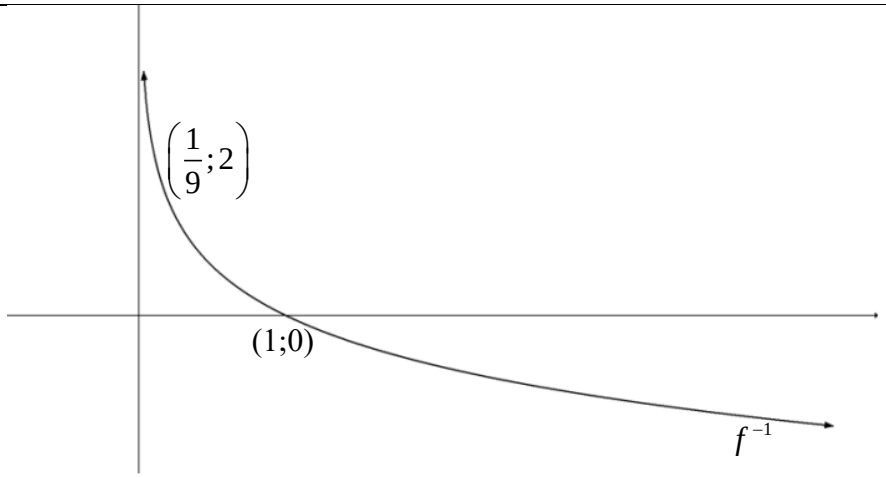
QUESTION 6

6.1.1	$h(x)=-x+c$ $y=-x+c$ $3=-(2)+c$ $c=5$ $h(x)=-x+5$	✓ subst. ✓ answer (2)
6.1.2	$y=-x+5$ $4=-x+5$ $x=1$ $A(1;4)$	✓ subst. ✓ x-coordinates (2)
6.1.3	$f(x)=\frac{a}{x+p}+4$ $y=\frac{a}{x-1}+4$ $-2=\frac{a}{0-1}+4$ $a=6$ $f(x)=\frac{6}{x-1}+4$	✓ subst. ✓ a value ✓ equation (3)
6.1.4	$f(x)=\frac{6}{(x+1)-1}+4$ $f(x)=\frac{6}{x}+4$ $y=4$ $x=0$	✓ $y=4$ ✓ $x=0$ (2)
6.1.5	$D'\left(-3;\frac{5}{2}\right)$	✓ ✓ (2)

6.2		✓ asymptotes ✓ intercepts ✓ shape (3)
		[14]

QUESTION 7

7.1	$f(x)=k^x, \left(2;\frac{1}{9}\right)$ $y=k^x$ $\frac{1}{9}=k^2$ $k=\pm\frac{1}{3}$ $k=\frac{1}{3}$ $f(x)=\left(\frac{1}{3}\right)^x$	✓ substitution ✓ answer (2)

7.2	$y \in (0;\infty) / y > 0$	✓ answer (1)
7.3	By reflecting graph across the line $y = x$.	✓ answer (1)
7.4	$y = \left(\frac{1}{3}\right)^x$ $x = \left(\frac{1}{3}\right)^y$ $y = \log_{\frac{1}{3}} x$	✓ swap x and y ✓ answer (2)
7.5		✓ shape ✓asymptote ✓ x-intercept (3)
7.6	$\left[f(x)\right]^2 - \left[f(-x)\right]^2 = f(2x) - f(-2x)$ LHS $= \left[\left(\frac{1}{3}\right)^x\right]^2 - \left[\left(\frac{1}{3}\right)^{-x}\right]^2$ $= 3^{-2x} - 3^{2x}$ RHS $= \left(\frac{1}{3}\right)^{2x} - \left(\frac{1}{3}\right)^{-2x}$ $= 3^{-2x} - 3^{2x}$ $\therefore LHS = RHS$	✓ substitution LHS ✓ substitution RHS ✓ simplification (3)
		[12]

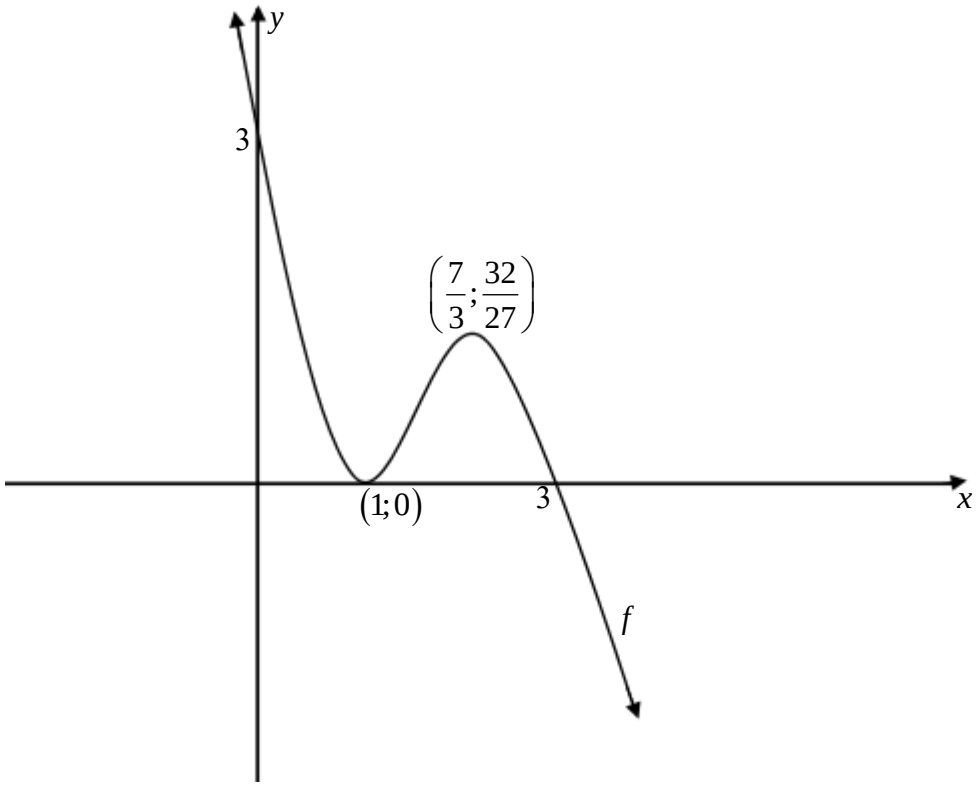
QUESTION 8

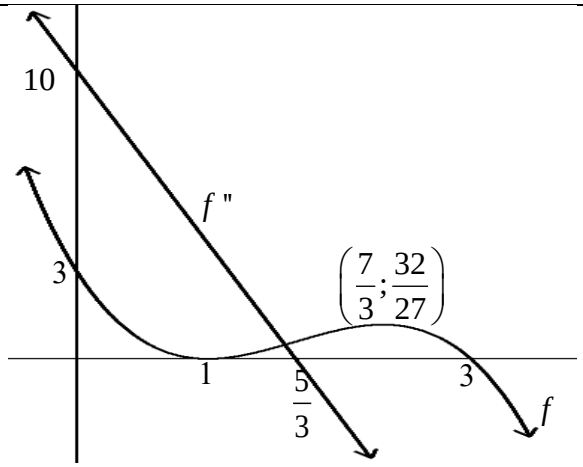
8.1	$f(x)=x^2-3$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $f'(x)=\lim_{h\to 0}\frac{(x+h)^2-3-(x^2-3)}{h}$ $f'(x)=\lim_{h\to 0}\frac{x^2+2xh+h^2-3-x^2+3}{h}$ $f'(x)=\lim_{h\to 0}\frac{2xh+h^2}{h}$ $f'(x)=\lim_{h\to 0}\frac{h(2x+h)}{h}$ $f'(x)=\lim_{h\to 0}(2x+h)$ $f'(x)=2x$	✓ substitution ✓ simplification ✓ common factor ✓ $=\lim_{h\to 0}(-2x-h)$ ✓ answer (5)
8.2	$y=\frac{9x^4-6}{3x}$ $y=\frac{9x^4}{3x}-\frac{6}{3x}$ $y=3x^3-2x^{-1}$ $\frac{dy}{dx}=9x^2+2x^{-2}$	✓ $y=3x^3-2x^{-1}$ ✓ $9x^2$ ✓ $2x^{-2}$ (3)
8.3	$\frac{d}{dx}\left[\frac{\sqrt[3]{x^3}-2x\sqrt{x}}{3x}\right]$ $=\frac{d}{dx}\left[\frac{x-2x^{\frac{3}{2}}}{3x}\right]$ $=\frac{d}{dx}\left[\frac{1}{3}-\frac{2}{3}x^{\frac{1}{2}}\right]$ $=\frac{d}{dx}\left[\frac{1}{3}\right]-\frac{d}{dx}\left[\frac{2}{3}x^{\frac{1}{2}}\right]$ $=0-\frac{1}{3}x^{-\frac{1}{2}}$ $=-\frac{1}{3\sqrt{x}}$	✓ x ✓ $2x^{\frac{3}{2}}$ ✓✓ $0-\frac{1}{3}x^{-\frac{1}{2}}$ (4)

8.4	$f(x)=x^3-2x+1$ $f'(x)=3x^2-2$ $3=3x^2-2$ $\frac{5}{3}=x^2$ $x=\pm\sqrt{\frac{5}{3}}$	✓ $3=3x^2-2$ ✓ $x=\pm\sqrt{\frac{5}{3}}$ (2)
		[14]

QUESTION 9

9.1.1	$f(x)=-x^3+5x^2-7x+3$ $(0;3)$	✓ $(0;3)$ (1)
9.1.2	$f(x)=-x^3+5x^2-7x+3$ $(x-1)(-x^2+4x-3)=0$ $(x-1)(x-1)(x-3)=0$ $x=1$ or $x=3$	✓ linear factor ✓ quadratic factor ✓ factors ✓ answer (4)
9.1.3	$f(x)=-x^3+5x^2-7x+3$ $f'(x)=-3x^2+10x-7$ $-3x^2+10x-7=0$ $3x^2-10x+7=0$ $(3x-7)(x-1)=0$ $x=\frac{7}{3}$ or $x=1$	✓ $f'(x)=0$ ✓ factors ✓ x-values

	$f\left(\frac{7}{3}\right)=-\left(\frac{7}{3}\right)^3+5\left(\frac{7}{3}\right)^2-7\left(\frac{7}{3}\right)+3=\frac{32}{27}$ $f(1)=-(1)^3+5(1)^2-7(1)+3=0$ $(1,0)$ and $\left(\frac{7}{3},\frac{32}{27}\right)$	✓ coordinates (4)
9.1.4		✓ y-intercept ✓ x-intercepts ✓ turning points ✓ shape (4)
9.1.5	$f'(x)=-3x^2+10x-7$ $f''(x)=-6x+10$ $-6x+10=0$ $-6x=-10$ $x=\frac{5}{3}$	✓ $f''(x)=-6x+10$ ✓ $-6x+10=0$ ✓ $x=\frac{5}{3}$ (3)

9.1.6		✓ intercepts ✓ shape (2)
9.1.7	$f''(x) > 0$ $-6x+10 > 0$ $-6x > 10$ $x < \frac{5}{3}$	✓ $-6x+10 > 0$ ✓ answer (2)
9.1.8	$x \in \left(1;\frac{7}{3}\right) \cup (3;\infty)$ Or $1 \le x \le \frac{7}{3}$ or $x \ge 3$	✓ $x \in \left(1;\frac{7}{3}\right)$ ✓ $(3;\infty)$ (2) OR ✓ $1 \le x \le \frac{7}{3}$ ✓ $x \ge 3$ (2)
9.2	$f(x) = x^3+3x^2-24x+20$ $x^3+3x^2-24x+20 = -8$ $x^3+3x^2-24x+28 = 0$ $(x-2)(x-2)(x+7) = 0$ $x = 2$ or $x = -7$ $P(-7,-8)$	✓ equating ✓ factors ✓ x-values ✓ coordinates of P (4)

9.3.1	$x=1$ and $x=5$	✓ $x=1$ ✓ $x=5$ (2)
9.3.2	The graph of f is decreasing on the intervals $x\in(0,1)$ and $x\in(5,6)$.	✓✓ notation, end points ✓✓ notation, end points (4)
		[32]