c) $\lim_{x\to 1} \frac{x-4x^4+3x^5}{(x-1)^2}$

With $f(x)=x-4x^4+3x^5$ and $g(x)=(x-1)^2$ $f(1)=g(1)=0$. $f(x)$ and $g(x)$ are polynomials and hence differentiable on $\mathbb{R}$, so $f(x)$ and $g(x)$ satisfy the conditions of L'Hopitals rule at $x=1$.

hence $\lim_{x\to 1}\frac{f(x)}{g(x)} = \lim_{x\to 1}\frac{f'(x)}{g'(x)} \stackrel{\text{if this exists}}{=} \frac{1-16x^3+15x^4}{2(x-1)}$

$f'(1)=g'(1)=0$. $f'(x)$ and $g'(x)$ are polynomials and are so differentiable on $\mathbb{R}$, so $f'(x)$ and $g'(x)$ satisfy the conditions of L'Hopitals rule at $x=1$

$\lim_{x\to 1}\frac{f(x)}{g(x)} = \lim_{x\to 1}\frac{f'(x)}{g'(x)} = \lim_{x\to 1}\frac{f''(x)}{g''(x)} = \lim_{x\to 1}\frac{-48x^2+60x^3}{2}$

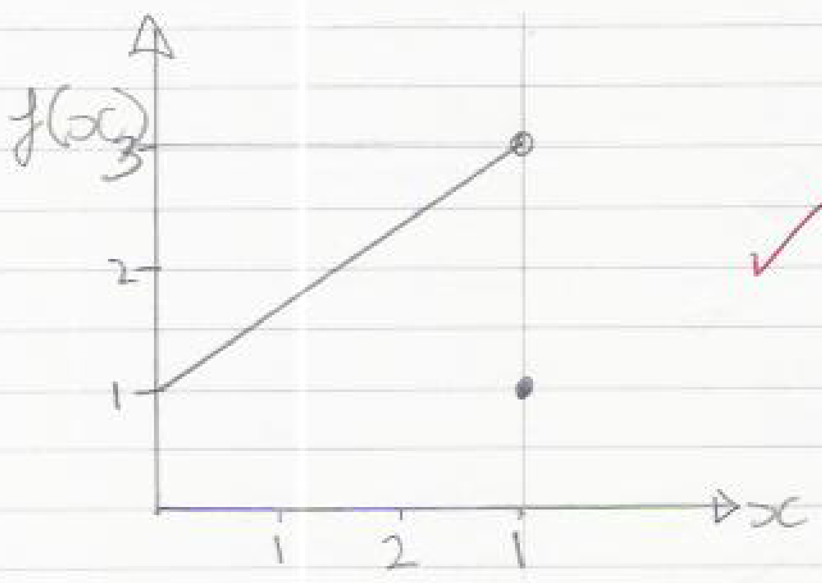
!! $= \frac{-48+60}{2} = 6.$

$\frac{9\frac{1}{2}}{10}$

Hence $\lim_{x\to 1}\frac{x-4x^4+3x^5}{(x-1)^2}$ exists and is equal to 6. ✓

$\frac{24}{25}$

2) a) i) $f(x)=\begin{cases} 1+2x & 0\le x<1 \\ 1 & x=1.\end{cases}$



✓ 1/1