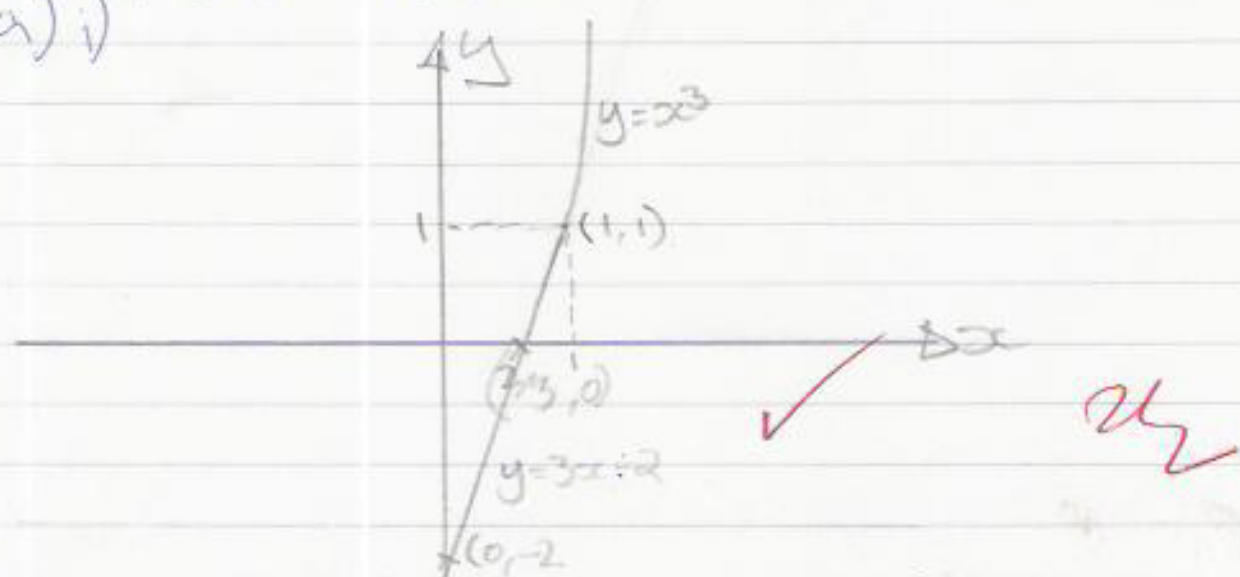


TMA 07 M203

1) a) i)



ii) Form the difference quotients for $x \rightarrow 1^-$ and $x \rightarrow 1^+$ (Since $3x-2$ and x^3 are polynomials, given differentiable).

$$f(x) = \begin{cases} 3x-2 & x < 1 \\ x^3 & x \geq 1 \end{cases}$$

$Q(h) = \frac{f(c+h) - f(c)}{h}$, difference quotient at c .

Put $x = 1-h$ then $x < 1$, $f(x) = 3x-2$

$$\lim_{h \rightarrow 0^-} Q(h) = \frac{f(1-h) - f(1)}{h}$$

$$= \frac{3(1-h) - 2 - 3 \times 1 + 2}{h}$$

$$= \frac{3 - 3h - 2 - 3 + 2}{-h} = \frac{-3h}{-h} = 3$$

Please don't omit these lines

Put $x = 1+h$

$$\lim_{h \rightarrow 0^+} Q(h) = \frac{f(1+h) - f(1)}{h}$$

$$= \frac{f(1+h) - f(1)}{h}$$

$$= \frac{(1+h)^3 - 1^3}{h} = \frac{1 + 3h + 3h^2 + h^3 - 1}{h}$$

$$= \frac{3h + 3h^2 + h^3}{h} = 3 + 3h + h^2 \rightarrow 3 \text{ as } h \rightarrow 0$$

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