Marked example 3

Paper 1 style · No calculator

3 8 marks SL 5.1 ●○○ Routine

Let $f(x) = 2x^2 - x$.

(a) Find the average rate of change of f from $x = 1$ to $x = 3$. **[2]**

(b) Show that $\dfrac{f(1+h) - f(1)}{h} = 3 + 2h$, for $h \neq 0$. **[3]**

(c) Hence write down the value of $f'(1)$. **[1]**

(d) Find the equation of the tangent to the graph of f at the point where $x = 1$. **[2]**

MARKSCHEME (a)

$\dfrac{f(3) - f(1)}{3 - 1} = \dfrac{15 - 1}{2}$ **(M1)**

$= 7$ **A1**

Total 2 marks

MARKSCHEME (b)

$f(1+h) = 2(1+h)^2 - (1+h)$ **M1**

$= 1 + 3h + 2h^2$ **A1**

$\dfrac{1 + 3h + 2h^2 - 1}{h} = \dfrac{3h + 2h^2}{h}$ **A1**

$= 3 + 2h$ **AG**

Total 3 marks

Note The brackets around $1 + h$ are essential: $2 \cdot 1 + h^2$ is a common error and earns M0.

MARKSCHEME (c)

$f'(1) = 3$ **A1**

Total 1 mark

Note The limit of $3 + 2h$ as $h \to 0$.

MARKSCHEME (d)

$f(1) = 1$: $y - 1 = 3(x - 1)$ **(M1)**

$y = 3x - 2$ **A1**

Total 2 marks

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