Marked example 1

Paper 1 style · No calculator

1 5 marks SL 5.1 ●○○ Routine

The depth of water in a garden pond is $h(t)$ centimetres, where t is the time in days since the start of a dry spell. The table shows the average rate of change of the depth, $\dfrac{h(2+\delta)-h(2)}{\delta}$, in centimetres per day, for decreasing values of δ.

δ (days)	1	0.1	0.01	0.001
average rate of change (cm per day)	-1	-0.82	-0.802	-0.8002

(a) Write down an estimate of the limit of the average rate of change as δ tends to zero. **[1]**

(b) Interpret this limit in the context of the question. **[2]**

The depth is modelled by $h(t) = 50 - 0.2t^2$, for $0 \le t \le 10$.

(c) Find $h'(t)$, and use it to confirm your estimate in part (a). **[2]**

MARKSCHEME (a)

-0.8 **A1**

Total 1 mark

MARKSCHEME (b)

the (instantaneous) rate of change of the depth when $t = 2$ **R1**

the depth is decreasing at 0.8 cm per day (two days after the start of the dry spell) **R1**

Total 2 marks

Note The second R1 needs both "decreasing" (or the sign) and the units. FT from their answer to (a).

MARKSCHEME (c)

$h'(t) = -0.4t$ **A1**

$h'(2) = -0.8$, which agrees with the estimate **A1**

Total 2 marks

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