

2.1 Derivative Basics: Quiz B Key

Tutor copy. Every answer was checked by symbolic computation (SymPy, `verify_quiz.py`). All problems are original; see the notes file for provenance. Prepared with assistance from Claude, an AI model made by Anthropic.

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General grading rules

- **Answer-only items** (Q1, Q3): all or nothing.
- **Value vs. derivative.** Giving a slope where a value was asked (or the reverse) earns 0 for that part.
- **Show-work items** (Q2, Q4, Q5): a bare correct answer earns at most half credit.
- **Definition items** (Q4(a), Q5): the problem states the required method. A correct answer found another way (for example, a power rule learned elsewhere) earns at most 2 of the 8 points.
- **Method is not graded for efficiency.** A correct answer reached by long but valid work gets full credit.

Quiz B

Item	Answer	Rubric / trap
1(a)	1	This is the c -form of $f'(1)$, the slope of the dashed tangent: it passes through grid points two units apart, e.g. $(0, 3)$ and $(2, 5)$. <i>Trap</i> : the height $f(1) = 4$; earns 0.
1(b)	0	No division by h : $f(1+h) \rightarrow f(1)$, so the difference goes to 0. <i>Trap</i> : the slope 1; earns 0.
1(c)	$y - 4 = (x - 1)$, i.e. $y = x + 3$	Point $R = (1, 4)$, slope 1. Any correct form. <i>Trap</i> : using the height as the slope, or $x + 1$ for $x - 1$; earns 0.
1(d)	Q	Steepest uphill labeled point. Slopes at the labeled points: P : -3 , Q : 3 , R : 1 , S : -3 , T : -5 . <i>Trap</i> : R , the highest labeled point, or T , the steepest labeled point, which goes downhill; earns 0.
1(e)	Q, R	Points where the graph is going up (left to right). All or nothing. <i>Trap</i> : P, Q, R, S , the points above the x -axis.
2	-6	1 pt $f(5) = -10$; 1 pt $f(2) = 8$; 2 pts quotient $= -6$. <i>Trap</i> : this is a secant slope, not a limit; $f'(2) = 0$ earns 0.
3(a)	$c = 16$	$f(16+h) - f(16) = \sqrt{16+h} - \sqrt{16} = \sqrt{16+h} - 4$. (The limit is $f'(16) = \frac{1}{8}$, but the question asks for c .) <i>Trap</i> : $c = 4$, from the $4 = \sqrt{16}$ in the numerator; earns 0. Giving the limit value $\frac{1}{8}$ instead of c earns 0.
3(b)	-6	Factor: $\frac{(3-x)(3+x)}{x-3} = -(3+x) \rightarrow -6$. <i>Trap</i> : 6, the slope of x^2 at 3; the numerator is $f(3) - f(x)$, reversed; earns 0.
4(a)	$f'(x) = \frac{1}{2\sqrt{x+5}}$	2 pts $f(x+h) = \sqrt{x+h+5}$ in the quotient; 2 pts multiplying top and bottom by $\sqrt{x+h+5} + \sqrt{x+5}$; 2 pts numerator $(x+h+5) - (x+5) = h$, cancel h : $\frac{1}{\sqrt{x+h+5} + \sqrt{x+5}}$; 2 pts letting $h \rightarrow 0$. <i>Trap</i> : letting $h \rightarrow 0$ before rationalizing gives $\frac{0}{0}$; writing $\sqrt{x+h+5} = \sqrt{x+5} + \sqrt{h}$ is false. Writing $f(x) + h$ for $f(x+h)$ earns at most 2.

Item	Answer	Rubric / trap
4(b)	$(-1, 2)$	2 pts solving $f'(x) = \frac{1}{2\sqrt{x+5}} = \frac{1}{4}$: $2\sqrt{x+5} = 4$, so $\sqrt{x+5} = 2$ and $x = -1$; 2 pts the point (f evaluated there). Follow-through: full credit for correctly using the student's own $f'(x)$. <i>Trap</i> : giving only $x = -1$ earns 2. Dropping the 2 ($\sqrt{x+5} = 4$, $x = 11$) earns 0 for the point.
5	$g'(-4) = -1$	1 pt $g(-4) = -12$; 2 pts setup; 3 pts algebra: $\frac{x^2 + 7x + 12}{x - (-4)} = \frac{(x+4)(x+3)}{x+4} = x+3$; 2 pts value at $x = -4$. <i>Trap</i> : the denominator is $x - (-4) = x + 4$; writing $x - 4$ gives a limit that does not exist. $g(-4) = 16 - 28 = -12$, so subtracting it adds 12.

Points: $10 + 4 + 6 + 12 + 8 = 40$.