

2.1 Derivative Basics: Quiz D 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 D

Item	Answer	Rubric / trap
1(a)	-2	This is the h -form of $f'(1)$, the slope of the dashed tangent: it passes through grid points two units apart, e.g. $(0, 3)$ and $(2, -1)$. <i>Trap</i> : the height $f(1) = 1$; 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 -2; earns 0.
1(c)	$y - 1 = -2(x - 1)$, i.e. $y = 3 - 2x$	Point $R = (1, 1)$, slope -2. Any correct form. <i>Trap</i> : using the height as the slope, or $x + 1$ for $x - 1$; earns 0.
1(d)	P	Steepest uphill labeled point. Slopes at the labeled points: P : 4, Q : 1, R : -2, S : -1, T : $\frac{5}{2}$. <i>Trap</i> : Q , the highest labeled point; earns 0.
1(e)	R, S	Points where the graph is going down (left to right). All or nothing. <i>Trap</i> : P, S, T , the points below the x -axis.
2	$-\frac{1}{8}$	1 pt $f(4) = \frac{1}{4}$; 1 pt $f(2) = \frac{1}{2}$; 2 pts quotient $= -\frac{1}{8}$. <i>Trap</i> : this is a secant slope, not a limit; $f'(2) = -\frac{1}{4}$ earns 0.
3(a)	$c = -2$	$f(-2+h) - f(-2) = (-2+h)^3 - (-8) = (h-2)^3 + 8$. (The limit is $f'(-2) = 12$, but the question asks for c .) <i>Trap</i> : $c = 2$, reading $(h-2)$ as $(2+h)$; earns 0. Giving the limit value 12 instead of c earns 0.
3(b)	-6	Expand: $\frac{-6h+h^2}{h} = -6+h \rightarrow -6$. <i>Trap</i> : 6, the slope of x^2 at 3; the input is $3-h$, not $3+h$; earns 0.
4(a)	$f'(x) = 3x^2 + 6x$	2 pts $f(x+h) = (x+h)^3 + 3(x+h)^2$, substituted correctly with parentheses; 2 pts expanding and subtracting $f(x)$ to get $3x^2h + 3xh^2 + h^3 + 6xh + 3h^2$; 2 pts dividing by h : $3x^2 + 3xh + h^2 + 6x + 3h$; 2 pts letting $h \rightarrow 0$. <i>Trap</i> : $(x+h)^3 = x^3 + 3x^2h + 3xh^2 + h^3$ and $3(x+h)^2 = 3x^2 + 6xh + 3h^2$; writing $x^3 + h^3$ loses the middle terms. Writing $f(x) + h$ for $f(x+h)$ earns at most 2.

Item	Answer	Rubric / trap
4(b)	$(-2, 4)$ and $(0, 0)$	2 pts $f'(x) = 3x^2 + 6x = 0$ gives $x = -2, 0$; 2 pts $f(-2) = 4$; $f(0) = 0$. Follow-through: if 4(a) is wrong, full credit for correctly using the student's own $f'(x)$ (if it has a zero). <i>Trap</i> : stopping at $x = -2$ (dropping $x = 0$ when dividing $3x^2 + 6x = 0$ by x) earns 3; x -values only earns 2.
5	$g'(-1) = 2$	1 pt $g(-1) = 1$; 2 pts setup; 3 pts algebra: $\frac{\frac{1}{x^2} - 1}{x + 1} = \frac{1 - x^2}{x^2(x + 1)} = \frac{(1 - x)(1 + x)}{x^2(x + 1)} = \frac{1 - x}{x^2}$; 2 pts value at $x = -1$. <i>Trap</i> : $g(-1) = \frac{1}{(-1)^2} = 1$, not -1 ; the denominator is $x - (-1) = x + 1$; a sign slip in $1 - x^2 = (1 - x)(1 + x)$ gives -2 .

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