

2.1 Derivative Basics: Quiz C 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 C

Item	Answer	Rubric / trap
1(a)	-2	The numerator is reversed, so this is $-f'(-2)$; the dashed tangent has slope 2: it passes through grid points two units apart, e.g. $(-3, 1)$ and $(-1, 5)$. <i>Trap</i> : 2, the slope itself: the numerator is $f(-2) - f(x)$, reversed, so the limit is $-f'(-2)$; earns 0.
1(b)	3	f is continuous at Q , so the limit is the height $f(-2) = 3$. <i>Trap</i> : the slope 2; earns 0.
1(c)	$y - 3 = 2(x + 2)$, i.e. $y = 2x + 7$	Point $Q = (-2, 3)$, slope 2. Any correct form. <i>Trap</i> : using the height as the slope, or $x - 2$ for $x - (-2)$; earns 0.
1(d)	P	Steepest downhill labeled point. Slopes at the labeled points: P : -3, Q : 2, R : -2, S : 3, T : 5. <i>Trap</i> : S , the lowest labeled point, or T , the steepest labeled point, which goes uphill; earns 0.
1(e)	Q, S, T	Points where the graph is going up (left to right). All or nothing. <i>Trap</i> : P, Q, R, T , the points above the x -axis.
2	-4	1 pt $f(-1) = 4$; 1 pt $f(1) = -4$; 2 pts $\frac{4 - (-4)}{-2} = -4$. Simplifying the quotient to $h^2 + 3h - 2$ first and then substituting $h = -2$ also works; no particular method is required. <i>Trap</i> : this is the slope of a secant line, not a limit. Letting $h \rightarrow 0$ gives $f'(1) = -2$; earns 0.
3(a)	$c = -2$	$f(-2 + h) - f(-2) = \frac{1}{-2 + h} - \left(-\frac{1}{2}\right) = \frac{1}{h - 2} + \frac{1}{2}$. (The limit is $f'(-2) = -\frac{1}{4}$, but the question asks for c .) <i>Trap</i> : $c = 2$, from the 2s in the numerator; earns 0. Giving the limit value $-\frac{1}{4}$ instead of c earns 0.
3(b)	4	Expand: $\frac{4h + 4h^2}{h} = 4 + 4h \rightarrow 4$. <i>Trap</i> : 2, the slope of x^2 at 1, ignoring the $2h$ inside; earns 0.

Item	Answer	Rubric / trap
4(a)	$f'(x) = \frac{2}{(x+2)^2}$	2 pts $f(x+h) = \frac{x+h}{x+h+2}$; 2 pts common denominator, numerator $(x+h)(x+2) - x(x+h+2) = 2h$; 2 pts cancel h : $\frac{2}{(x+h+2)(x+2)}$; 2 pts letting $h \rightarrow 0$. <i>Trap</i> : the x^2 and xh terms cancel in the numerator, leaving $2h$; a student who expands only one product gets a numerator that does not cancel h . Writing $\frac{x}{x+2} + h$ for $f(x+h)$ earns at most 2.
4(b)	$(-3, 3)$ and $(-1, -1)$	2 pts solving $f'(x) = \frac{2}{(x+2)^2} = 2$: $(x+2)^2 = 1$, so $x = -3$ or $x = -1$; 2 pts the points (f evaluated there). Follow-through: full credit for correctly using the student's own $f'(x)$. <i>Trap</i> : stopping after one solution ($x+2 = 1$ only) earns 3; x -values only earns 2. $f(-3) = \frac{-3}{-1} = 3$.
5	$g'(-2) = 15$	1 pt $g(-2) = -14$; 2 pts setup; 3 pts algebra: $\frac{x^3+3x+14}{x+2} = x^2 - 2x + 7$ (synthetic or long division by $x+2$ on 1, 0, 3, 14, with the zero placeholder; no particular method is required); 2 pts value at $x = -2$. <i>Trap</i> : $g(-2) = -8 - 6 = -14$, so the numerator is $x^3 + 3x + 14$. A student who drops the $0x^2$ placeholder gets a wrong quotient. The denominator is $x+2$.

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