

2.1 Derivative Basics: Quiz A 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 A

Item	Answer	Rubric / trap
1(a)	-1	This is the h -form of $f'(-2)$, the slope of the dashed tangent: it passes through grid points two units apart, e.g. $(-3, 5)$ and $(-1, 3)$. <i>Trap</i> : the height $f(-2) = 4$; earns 0.
1(b)	4	f is continuous at Q , so the limit is the height $f(-2) = 4$. <i>Trap</i> : the slope -1 ; earns 0.
1(c)	$y - 4 = -(x + 2)$, i.e. $y = 2 - x$	Point $Q = (-2, 4)$, slope -1 . Any correct form. <i>Trap</i> : using the height as the slope, or $x - 2$ for $x - (-2)$; earns 0.
1(d)	R	Steepest downhill labeled point. Slopes at the labeled points: P : $\frac{7}{2}$, Q : -1 , R : -4 , S : 1 , T : 5 . <i>Trap</i> : S , the lowest labeled point, or T , the steepest labeled point, which goes uphill; earns 0.
1(e)	Q, R	Points where the graph is going down (left to right). All or nothing. <i>Trap</i> : S , the points below the x -axis.
2	1	1 pt $f(3) = -3$; 1 pt $f(1) = -5$; 2 pts $\frac{-3 - (-5)}{2} = 1$. Simplifying the quotient to $2h - 3$ 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 $f'(1) = -3$; earns 0.
3(a)	$c = -1$	$f(-1 + h) - f(-1) = (-1 + h)^2 - 1 = (h - 1)^2 - 1$. (The limit is $f'(-1) = -2$, but the question asks for c .) <i>Trap</i> : $c = 1$, reading $(h - 1)$ as $(1 + h)$; earns 0. Giving the limit value -2 instead of c earns 0.
3(b)	0	Direct substitution: $(1 + 0)^3 - 1 = 0$. Nothing is divided by h , so there is no $\frac{0}{0}$. <i>Trap</i> : 3, the slope of x^3 at 1, from expanding $3h + 3h^2 + h^3$ and dividing by h out of habit; earns 0.

Item	Answer	Rubric / trap
4(a)	$f'(x) = -4x + 6$	2 pts $f(x + h) = -2(x + h)^2 + 6(x + h) - 1$, substituted correctly with parentheses; 2 pts expanding and subtracting $f(x)$ to get $-4xh - 2h^2 + 6h$; 2 pts dividing by h : $-4x - 2h + 6$; 2 pts letting $h \rightarrow 0$. <i>Trap</i> : $-2(x + h)^2$ expands to $-2x^2 - 4xh - 2h^2$; writing $-2x^2 + 4xh + 2h^2$ (sign not distributed) or $(-2x - 2h)^2$ gives a wrong numerator. Writing $f(x) + h$ for $f(x + h)$ earns at most 2.
4(b)	$(\frac{3}{2}, \frac{7}{2})$	2 pts $f'(x) = -4x + 6 = 0$ gives $x = \frac{3}{2}$; 2 pts $f(\frac{3}{2}) = \frac{7}{2}$. 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> : giving only x -values (the question asks for points) earns 2.
5	$g'(2) = -\frac{2}{3}$	1 pt $g(2) = 2$; 2 pts setup; 3 pts algebra: $\frac{\frac{6}{x+1} - 2}{x - 2} = \frac{6 - 2(x + 1)}{(x + 1)(x - 2)} = \frac{-2(x - 2)}{(x + 1)(x - 2)} = \frac{-2}{x + 1}$; 2 pts value at $x = 2$. <i>Trap</i> : subtracting 2 without a common denominator ($\frac{6-2}{x+1}$), or substituting $x = 2$ before canceling and stopping at $\frac{0}{0}$. Unreduced $-\frac{6}{9}$ is fine.

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