DATE ______________________

3.1–3.3 Concepts Worksheet

NAME ______________________

Differentiation

1. Given the following information about differentiable functions $f(x)$ and $g(x)$ at $x = 2$ and $x = 3$,

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
2	8	2	1/3	-3
3	3	-4	2π	5

determine the value of:

__________ a) $\frac{d}{dx}\{2f(x)\}$ at $x = 2$

__________ b) $\frac{d}{dx}\{f(x) + g(x)\}$ at $x = 3$

__________ c) $\frac{d}{dx}\{f(x) \cdot g(x)\}$ at $x = 3$

__________ d) $\frac{d}{dx}\left\{\frac{f(x)}{g(x)}\right\}$ at $x = 2$

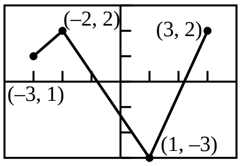
__________ e) $\frac{d}{dx}\{f(g(x))\}$ at $x = 2$

__________ f) $\frac{d}{dx}\{\sqrt{f(x)}\}$ at $x = 2$

__________ g) $\frac{d}{dx}\left\{\frac{1}{g(x)}\right\}$ at $x = 3$

__________ h) If $h(x) = \sqrt{f^2(x) + g^2(x)}$, then find $h'(2)$.

2.



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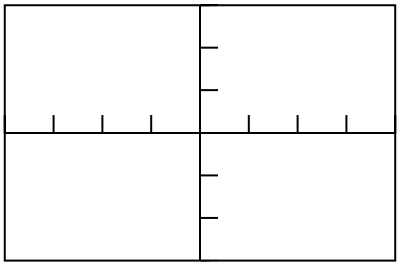

The graph of $f(x)$ with domain $[-3, 3]$ is composed of line segments as shown above.

(a) Sketch the graph of $f'(x)$ on the grid above.

(b) Name the x-coordinate of each point of discontinuity of $f'(x)$ over $(-3, 3)$.

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Concept Connectors

3. What points do you suspect of being points of discontinuity of the derivatives of these graphs? (Give the x-coordinates of the points of discontinuity of $f'(x)$.)

(a) $f(x) = x^2$

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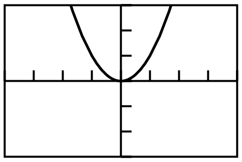

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(b) $f(x) = |x| - 1$

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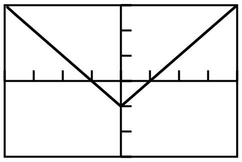

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(c) $f(x) = x^{1/3}$

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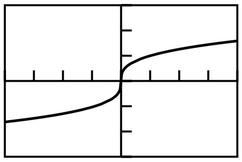

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(d) $f(x) = x^{2/3}$

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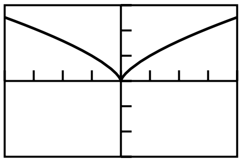

[–4, 4] by [–3, 3]

(e) $f(x) = |\ln x|$

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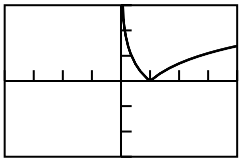

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(f) $f(x) = 2 \sin \frac{6}{x}$

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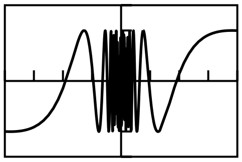

[–4, 4] by [–3, 3]

4. You may not have *formally* arrived at the "suspect" points called for above. Formal limit computations as described in Appendix A3 would rigorously prove derivative discontinuities. However, some of the examples used above would still seem difficult. In general, which characteristics on a curve would make you believe that the slope of a tangent line to the curve at that point is nonexistent?

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