Chapter 3 Test **October 1, 2012** **Name**

1. Use the definition of the derivative (not shortcuts!) to find $f'(x)$ if $f(x) = \dfrac{3}{1 - 2x}$

2. Find $f'(x)$ if $f(x) = \dfrac{\cos^{-1}\left(\log_2\left(x^2 - 3\right)\right)}{\cot\left(4^{3x^2}\right)}$ Make use of the quotient rule. DO NOT SIMPLIFY.

3. Find $f'(x)$ if $f(x) = \left(4^{\cos(3x)}\right)\left(\sec\left(\log_5\left(3x - x^2\right)\right)\right)$ DO NOT SIMPLIFY.

4. Find $f'(x)$ if $f(x) = \sqrt{\dfrac{\cot^{-1}\left(12 - x^3\right)}{\left(1 + x^2\right)\sin\left(x^2\right)}}$ Make use of the quotient rule. DO NOT SIMPLIFY.

5. Find $f'(x)$ if $f(x) = \left(3x^2 + (\tan(6 - x))\right)^{(\ln(3x - 7))}$ Give your answer in terms of x.

6. Find the slope of the normal line for $x^2 - 5xy + 3y^2 = 23$ at the point $(1, -2)$.

7. Find $f'(x)$ for $f(x) = \left| \frac{3}{2x} \right|$

8. Find (a) $\lim_{x \to 2^+} f'(x)$, (b) $\lim_{x \to 2^-} f'(x)$, (c) $\lim_{h \to 0^+} \frac{f(2+h) - f(2)}{h}$, and (d) $\lim_{h \to 0^-} \frac{f(2+h) - f(2)}{h}$ if

$$f(x) = \begin{cases} x^2 - 4x + 3 & \text{when } x < 2 \\ 1 & \text{when } x = 2 \\ \sqrt{x - 2} - 1 & \text{when } x > 2 \end{cases}$$

9. Express the following limit as a derivative, and simplify: $\lim_{h \to 0} \frac{3^{\left(2\left(\frac{-1}{2} + h\right)\right)} - \frac{1}{3}}{h}$

10. Suppose that f and g are differentiable at $x = 4$, and $f(4) = -1$, $f'(4) = 3$, $g(4) = 2$, $g'(4) = -2$.

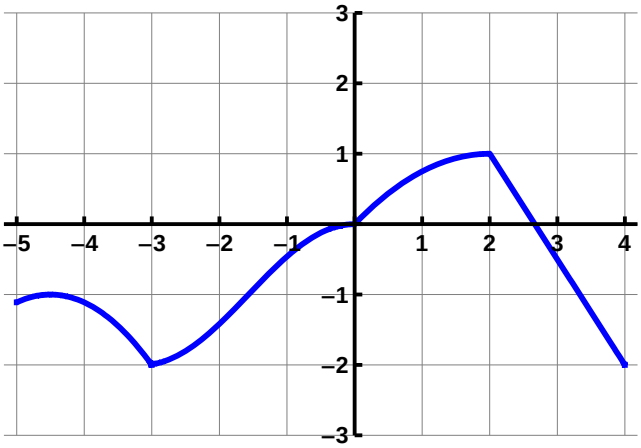
Find $\frac{d}{dx}\left(\frac{2g}{f}\right)$ at $x = 4$.

11. Find the equation of the tangent line for $x^2 y + y^2 x = 30$ at the point $(2, 3)$.

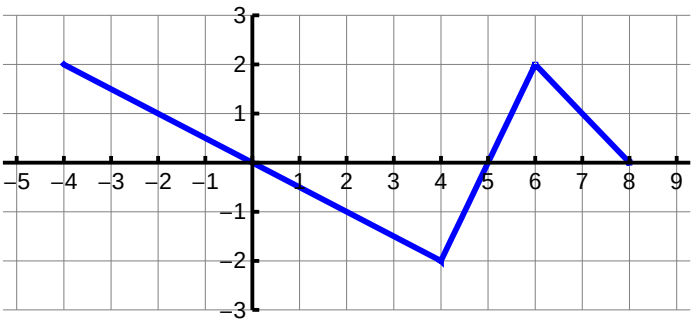
12. Find (a) $\lim_{x \to -1^+} f'(x)$, (b) $\lim_{x \to -1^-} f'(x)$, (c) $\lim_{h \to 0^+} \frac{f(-1+h) - f(-1)}{h}$, and (d) $\lim_{h \to 0^-} \frac{f(-1+h) - f(-1)}{h}$ if

$$f(x) = \begin{cases} \sin(x+1) & \text{when } x < -1 \\ -1 & \text{when } x = -1 \\ -(2^{-x}) & \text{when } x > -1 \end{cases}$$

13. For the following position curve, draw a related velocity curve on the same axes.



14. The graph of $f(x)$ is shown. Draw the graph of $-f(2x - 4) + 1$, on the same set of coordinate axes.



15. The following data give the coordinates of a moving body :

t (seconds)	0	2	5	7	10	13	17
s (meters)	2	7	10	12	15	21	26

(a) Find the average velocity of the body on the interval [0, 17]

(b) Approximate the instantaneous rate of change (velocity) at t = 10 seconds

(c) Approximate the acceleration at t = 10 seconds

16. Consider the function $f(x) = \begin{cases} 2x + 7 & x < -3 \\ x^2 + 8x + 16 & x \geq -3 \end{cases}$

Is this function differentiable on the following intervals? Justify your answers.

(a) [–3, 5] (b) [–5, 2] (c) [–8, –3]

17. Consider the function $f(x) = \begin{cases} -x^2 + 5x & x \leq 4 \\ 2\sqrt{x} & x > 4 \end{cases}$

Is this function differentiable on the following intervals? Justify your answers.

(a) [–3, 4] (b) [–1, 6] (c) [4, 9]