Chapter 3 Test **September 26, 2016** **Name**

1. Use the definition of the derivative (not shortcuts!) to find $f'(x)$ if $f(x) = \dfrac{5}{1 - x}$

2. If $f(x) = \sqrt{\dfrac{2x + 1}{3x + 1}}$ then find $f'(-1)$. Make use of the quotient rule (among others).

3. Find the values of a and b that make $f(x)$ differentiable at $x = 2$ if

$$f(x) = \begin{cases} ax^2 + 10 & \text{when } x \le 2 \\ x^2 - 6x + b & \text{when } x > 2 \end{cases}$$

4. If $g(x) = (2x^2 - 4x + 1)(\arcsin(x))$ is the derivative of $f(x)$, find $\lim\limits_{z \to 0} \dfrac{f\left(\frac{-1}{2} + z\right) - f\left(\frac{-1}{2}\right)}{z}$

5. If $f(x) = \sqrt{2 + 4\cos\left(\dfrac{x}{2}\right)}$ then find $f'\left(\dfrac{-2\pi}{3}\right)$

6. If $f(x) = \dfrac{-1}{1 + x}$ when $x > -1$, and g is the inverse of f, then find the value of $g'(-1)$

7. Find the slope of the tangent line for the curve $7 = 3y^2 + 2\sqrt{xy}$ at the point $(-4, -1)$

8. Given that $F(x) = (g(f(x)))^3$, $g(1) = 3$, $g'(1) = -2$, $f(3) = 1$, and $f'(3) = 4$, find $F'(3)$

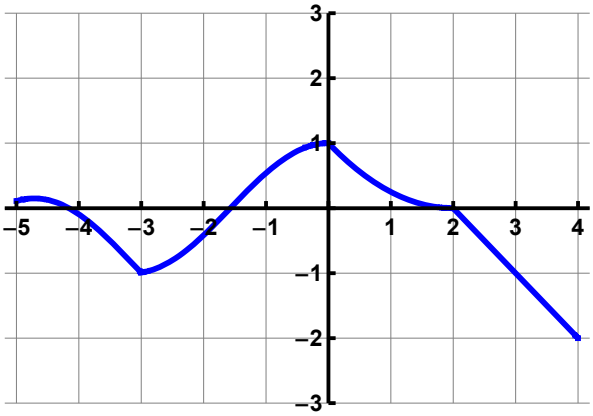
9. Find (a) $\lim_{x \to -2^+} f'(x)$, (b) $\lim_{x \to -2^-} f'(x)$, (c) $\lim_{h \to 0^+} \dfrac{f(-2 + h) - f(-2)}{h}$, and (d) $\lim_{h \to 0^-} \dfrac{f(-2 + h) - f(-2)}{h}$ if

$$f(x) = \begin{cases} x^2 + x + 1 & \text{when } x < -2 \\ 1 & \text{when } x = -2 \\ -3x - 6 & \text{when } x > -2 \end{cases}$$

10. Find (a) $\lim_{x \to \frac{\pi}{3}^+} f'(x)$, (b) $\lim_{x \to \frac{\pi}{3}^-} f'(x)$, (c) $\lim_{h \to 0^+} \frac{f\left(\frac{\pi}{3} + h\right) - f\left(\frac{\pi}{3}\right)}{h}$, and (d) $\lim_{h \to 0^-} \frac{f\left(\frac{\pi}{3} + h\right) - f\left(\frac{\pi}{3}\right)}{h}$ if

$$f(x) = \begin{cases} \sin\left(\frac{x}{2}\right) & \text{when } x < \frac{\pi}{3} \\ \cos(5x) & \text{when } x \geq \frac{\pi}{3} \end{cases}$$

11. For the following position curve, draw the graph of the related velocity curve on the same axes.



12. A curve is parametrized by the equations $x = -\csc(2t)$ and $y = \cot(3t)$. Find the slope of the line tangent to the curve at the point defined by $t = \frac{-5\pi}{6}$

13. Determine whether the function $f(x) = \sqrt{x - 4}$ is differentiable on its domain. Justify your answer

14. Using the secondary form of the definition of the derivative, and if $f(x) = x^2 - 2x + 3$, then find $f'(2)$ Do not use any shortcuts, and use the secondary definition of the derivative.

15. If $f(x) = (\arctan(2x))^{2\cos(3x)}$ then find $f'(x)$

16. Find $\lim_{h \to 0} \dfrac{\sin\left(2\left(\frac{-\pi}{6} + h\right)\right) - \left(\frac{-\sqrt{3}}{2}\right)}{h}$

17. If $f(x) = \left|\sqrt[5]{2x - 4}\right|$ then find $f'(x)$