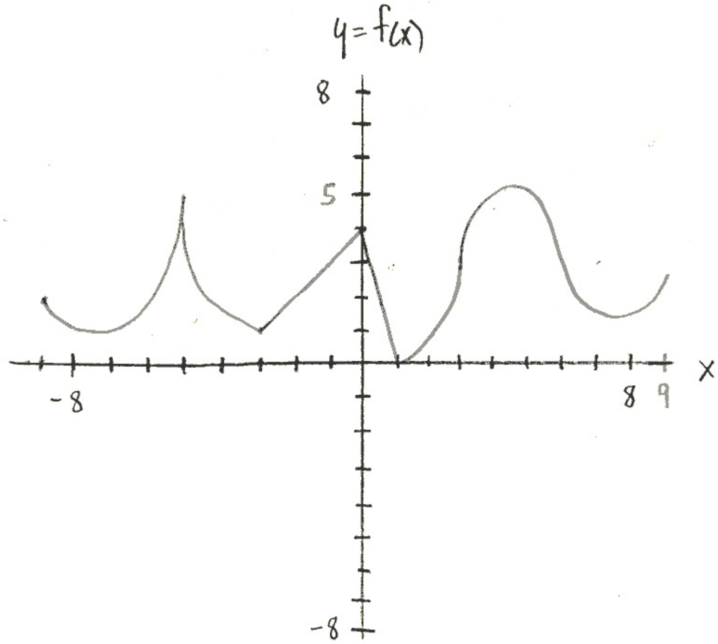
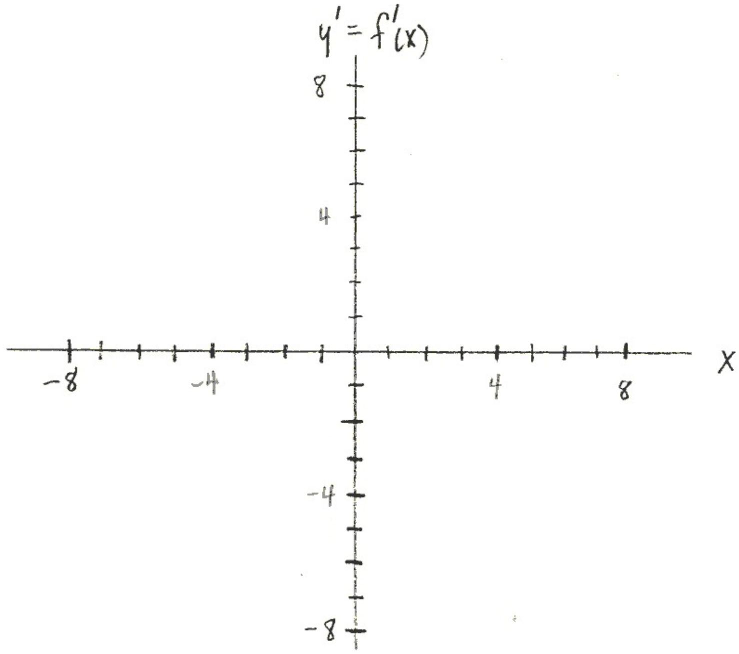
Name:_________________________________

1. Define **derivative of a function f.** (Copy it word for word from the text.)

2. Given this graph of y = f(x) having a vertical tangent, a cusp and a corner, draw the graph of y = f'(x).





3. Calculate the derivative of

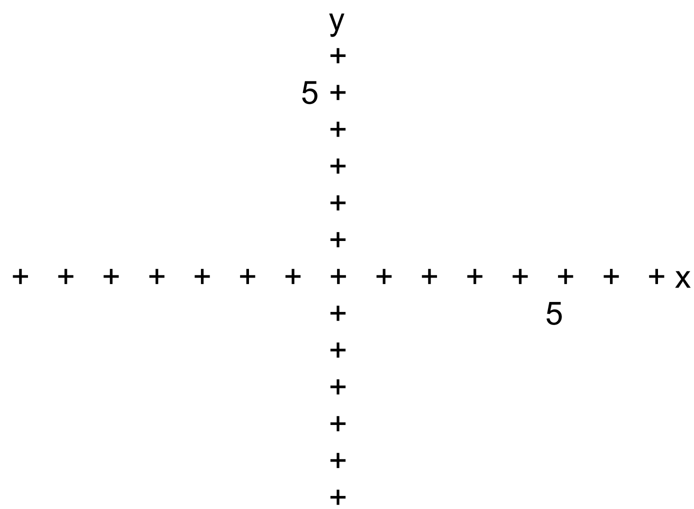
$$f(x) = \frac{2x - 3}{4x + 1}$$

by the defi

i.e., using the limit of the difference quotient.

4. Sketch a graph of a function f that has these given values of f and f '. Label the axes with numbers.

x	f(x)	f'(x)
1		-1
2		0
3	1	1
4		2
5		0



5. Estimate the values of f ' numerically from the values of the function f.

x	f(x)	f'(x)
16	300	
20	340	
24	360	
28	370	
32	370	
36	350	

6. Differentiate the following using the power rule.

$$y = f(x) = 9x^5 + 4x - 7 + 2x^{-5} + \frac{4}{x^3}$$

$f'(x) =$

$f''(x) =$

7. Apply the rules (of theorems) of differentiation: sum, difference, product, quotient, power, constant factor. Differentiate these functions and simplify the result.

a. $f(x) = \dfrac{2x^5 + 4x}{3x - 1}$

$f'(x) =$

b. $g(x) = (2x^5 + 4x)\,(3x - 1)$

$g'(x) =$

8. Take derivatives involving these trigonometric functions.

a. $\dfrac{d}{dx}\,\dfrac{\cos x}{x}$

b. $D_x\,(x^3 \cdot \tan x)$

9. Apply the chain rule to find h '(x) and simplify the result.

a. $h(x) = (5x^2 - 4x)^7$

b. $h(x) = \cos^4(x^3)$

c. $h(x) = \dfrac{\sin x}{\cos^4 x}$

10. Apply the chain rule to $y = \sqrt{u + 4}$, $u = 2x^2 + 5x$, $x = t^3 - 5t$

a. $\frac{dy}{dx}$

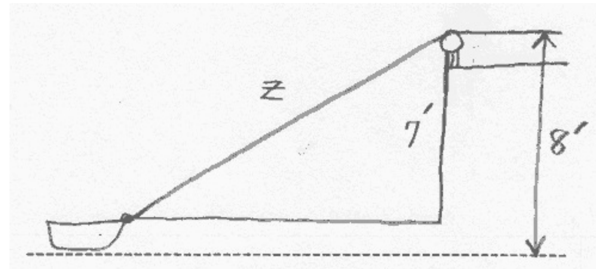
b. $\frac{dy}{dt}$

11. Differentiate the implicitly defined function to find and solve for $\frac{dy}{dx}$. Then find the equation of the tangent line at the point (1, 0).

$$x^2 y^5 - 4y^3 + 6y = x^2 \sin(y) - 4x$$

12. Solve this related rates problem:

A man on a dock is pulling in a boat using a rope attached to the bow of the boat 1 ft above water level and passing through a simple pulley located on the dock 8 ft above the water level. If he pulls in the rope at rate of 3 ft/sec , how fast is the boat approaching the dock when the bow of the boat is 24 ft from a point that is directly below the pulley?



13. Draw a diagram depicting x, y, dx, dy, Δx and Δy for a function f and describe each one with a phrase.

14. If $y = f(x) = 5\,(3x^3 - 4x)^4$, find dy, the differential of y.

15. Find this limit. $\lim_{x \to 0} \frac{\sin(3x)}{x\,\cos(x)}$

16. A spherical balloon is being inflated with gas. Use differentials to approximate the increase in surface area of the balloon if the radius changes from 3 ft to 3.05 ft.

17. Considering the function $y = f(x) = 3x^2 - 2x + 1$, do each of the following 6 items.

a. Find the slope of the secant line (m_{sec}) passing through the curve $y = f(x)$ at the x-values 2 and 2.3.

b. Find the slope of the tangent line (m_{tan}) at the x-value 2.

c. Give the equation of the secant line in part a above.

d. Give the equation of the tangent line in part b above at $x=2$.

e. Suppose $s = f(t) = 3t^2 - 2t + 1$ gives position s in feet of an object in terms of time t in seconds. Give the average velocity between time $t = 2$ and 2.3 seconds.

f. Give the instantaneous velocity v of the object at time 2 seconds.

18. **MATCH EACH FUNCTION IN SECTION A WITH ITS DERIVATIVE IN SECTION B**