Pre-Calculus

Write your questions and thoughts here!

15.3 Power Rule

Name:_____

Derivative of a Constant

$$\frac{d}{dx}C =$$

Find the derivative of the following:

1. $y = 8$
2. $y = 3\pi$
3. $y = 6e^5$

Power Rule

$$\frac{d}{dx}x^n =$$

Find the derivative of the following:

4. $y = x^4$
5. $h(r) = 3r^3$
6. $s(t) = \frac{t^7}{4}$

Rewrite to make it easier to use the power rule.

7. $y = \frac{5}{x^2}$
8. $f(t) = \sqrt{t}$
9. $A(w) = \sqrt[7]{w^3}$

Addition or Subtraction between terms? Just take the derivative of each term.

10. $y = 7x^3 + 6x^2 - x + 3$
11. $y = 30x^4 + \frac{5}{x} - 6x^{\frac{7}{3}}$

15.3 Power Rule

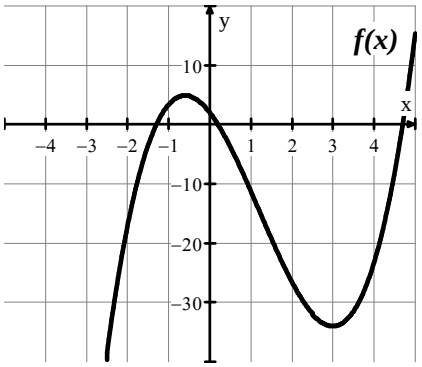
Write your questions and

Simplify First, then take the derivative

12. $y = \frac{3x^2-8x-2}{x}$

13. $y = \frac{x}{\sqrt{x}}$

14. Determine the point(s) at which $f(x) = \frac{5}{3}x^3 - 6x^2 - 9x + 2$ has a **horizontal tangent**.



Now summarize what you learned!

Skillz Review: Using the graph, find each value.

a. $\lim_{x\to 2^-} f(x) =$

b. $f(3) =$

c. $\lim_{x\to 0} f(x) =$

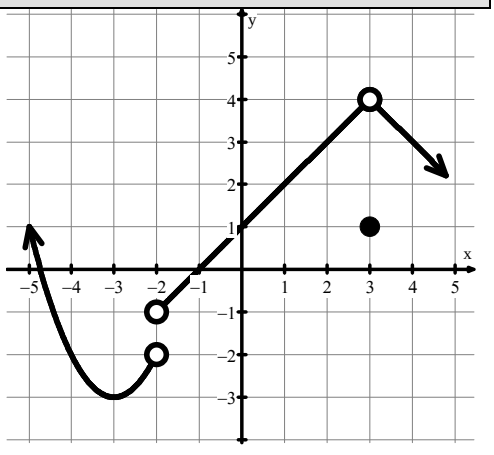
d. $\lim_{x\to -2^+} f(x) =$

e. $f(-2) =$

f. $\lim_{x\to -2^-} f(x) =$

g. $\lim_{x\to -2} f(x) =$

h. $f(2) =$



15.3 Practice – Power Rule

Name: _____

Pre-Calculus

Find the derivative of each function and simplify. Answers should contain only positive exponents.

1. $f(x) = 7x$	2. $y = 37$	3. $s(t) = -9t$	4. $s(t) = 4$
5. $y = x^2 - 8x + 10$	6. $f(x) = \frac{x}{5}$	7. $f(x) = \pi^2$	8. $f(x) = \frac{5}{x}$
9. $y = 8\sqrt{x}$	10. $s(t) = \frac{3}{t^4}$	11. $y = \frac{2}{x^2}$	12. $f(x) = 9\sqrt{x}$
13. $h(x) = 2e^3$	14. $s(t) = \frac{6}{\sqrt{t}}$	15. $y = \sqrt[3]{x}$	16. $f(x) = \sqrt[5]{x^7}$
17. $y = 11x^5 - 3x + 13$	18. $s(t) = 10 - 6t^3 + 7t$	19. $f(x) = e^6 + \pi^5 - 2$	20. $f(x) = \frac{x}{x^{-5}}$
21. $y = (x^2 + 6x - 2)(2x^{-2} + x^{-4})$		22. $h(x) = \sqrt{x}\left(\sqrt[3]{x} - \sqrt[4]{x}\right)$	
23. $h(x) = \frac{x^3 - 5x^2 + 7x}{x}$		24. $y = \frac{3x^5 + 2x^2 - 4}{x^2}$	

Find the value of the derivative of the function at the indicated point.

25. $f(x) = \frac{1}{x^2}$ at $(1,1)$	26. $f(x) = 8 - \frac{2}{3x}$ at $\left(\frac{2}{3}, 7\right)$	27. $f(x) = \frac{1}{3\sqrt{x}}$ at $\left(4, \frac{1}{6}\right)$

Determine the x-value(s) at which the function has a horizontal tangent line.			
28. $y = x^4 - 8x^2 + 2$	29. $y = x^3 - x$	30. $y = x^2 + 1$	31. $y = \frac{1}{x^2}$

Find the equation of a tangent line of each function at the indicated point.	
32. $f(x) = 2x^2 + 7x + 3; \quad x = -1$	33. $f(x) = 2x^3 - 5x; \quad x = -2$
34. $f(x) = \frac{16}{x} - \frac{x}{2}; \quad x = 4$	35. $f(x) = \frac{4}{\sqrt{x}} - x; \quad x = 9$

15.3 Extension

Higher-Order Derivatives. When you differentiate (take the derivative) of a function, you find the 1st derivative. Sometimes it is useful to take the derivative again, and maybe even a 3rd time. These are called the 2nd and 3rd derivatives respectively. One of the most common areas where this is used is with position, velocity, and acceleration.

Position function: $\boldsymbol{s(t)}$

Velocity function: $\boldsymbol{v(t) = s'(t)}$ [1st derivative of position]

Acceleration function: $\boldsymbol{a(t) = v'(t) = s''(t)}$ [1st derivative of velocity or 2nd derivative of position]

Use this information to answer the questions on the following page.

1. A car is traveling at a rate of 88 feet per second (60 miles per hour) when the brakes are applied. The position function for the car is $s(t) = -8.25t^2 + 88t$ where s is measured in feet and t is measured in seconds.

   a) How far has the car skidded after 2 seconds?

   b) Find a velocity function $v(t)$ for this car.

   c) What is the car's velocity after 2 seconds?

   d) How long until the car comes to rest (when is the velocity zero)?

   e) Find an acceleration function $a(t)$ for this car.

   f) When velocity and acceleration have the same sign (positive or negative), an object is speeding up. If they have different signs, the object is slowing down. In this situation, at 2 seconds what is the sign of velocity? What is the sign of acceleration? Is the object speeding up or slowing down?

2. Mr. Kelly and Mr. Sullivan are having a throwing contest to see who can throw a baseball the farthest. Mr. Kelly realizes that if he pays for a flight to the moon, he can throw a baseball further than on earth. Use the information below to compare Mr. Kelly and Mr. Sullivan's throws and fill in the chart. [h is measured in feet and t is measured in seconds.]

	Mr. Sullivan throwing on Earth	Mr. Kelly throwing on the Moon.
Height of the baseball	$h(t) = -16t^2 + 27t + 6$	$h(t) = -\frac{27}{10}t^2 + 27t + 6$
Find an expression for velocity.		
Find an expression for acceleration.		
Find the time when the baseball is at its highest point. (The velocity would be zero.)		
How high is the baseball at its highest point?		