

Write your questions  
and thoughts here!

Function	Function's Derivative
$f(x) = x^2$	$f'(x) =$
$f(x) = x^3$	$f'(x) =$
$f(x) = x^4$	$f'(x) =$
$f(x) = x^5$	$f'(x) =$

**The Power Rule**

$$f(x) = x^n$$

$$f'(x) =$$

Easy examples

1.  $y = x^{37}$

2.  $y = x^9$

Not as easy examples:

3.

Function	$y = \frac{1}{x}$
Rewrite	
Differentiate	
Simplify (rewrite)	

4.

Function	$y = \frac{1}{x^4}$
Rewrite	
Differentiate	
Simplify (rewrite)	

5.

Function	$y = \sqrt{x}$
Rewrite	
Differentiate	
Simplify (rewrite)	

6.

Function	$y = \sqrt[7]{x^3}$
Rewrite	
Differentiate	
Simplify (rewrite)	

Tricky examples: Simplify first, then take the derivative.

7.  $f(x) = \frac{x}{\sqrt{x}}$ . Find  $f'(7)$

8.  $f(x) = \sqrt[3]{x}(x^3)$ . Find  $f'(8)$

### Parallel Tangent Lines

9. Let  $f(x) = x^4$  and  $g(x) = x^3$ . At what value(s) of  $x$  do the graphs of  $f$  and  $g$  have parallel tangent lines.

## 2.5 The Power Rule

### Practice

Calculus

Find $\frac{dy}{dx}$ .			
1. $y = x^7$	2. $y = x$	3. $y = x^\pi$	4. $y = \frac{1}{x^5}$
5. $y = \frac{1}{\sqrt[4]{x}}$	6. $y = \sqrt[9]{x^4}$	7. $y = \sqrt[3]{x}$	8. $y = x^e$
9. $y = \frac{x}{\sqrt[3]{x}}$	10. $y = x^2(\sqrt[6]{x^5})$		

Find $f'(a)$ for each function at the given value of $a$ .			
11. $f(x) = x^4$ find $f'(-1)$	12. $f(x) = \sqrt{x}$ find $f'(16)$	13. $f(x) = \frac{1}{x^4}$ find $f'(2)$ .	14. $f(x) = \frac{1}{\sqrt[3]{x}}$ find $f'(27)$ .

Find the equation of the tangent line of each function at the given value of  $x$ .

15.  $y = x^3$  at  $x = -2$

16.  $f(x) = \sqrt[4]{x^3}$  at  $x = 1$

17.  $f(x) = \frac{1}{x^4}$  at  $x = 2$

When do the two functions listed have parallel tangent lines?

18.  $f(x) = x^2$  and  $g(x) = x^5$ .

19.  $f(x) = \sqrt{x}$  and  $g(x) = x^3$ . Use a calculator.

## 2.5 The Power Rule

**Test Prep**

20.  $\lim_{x \rightarrow e} \frac{(x^3) - (e^3)}{x - e}$  is

(A) 0

(B)  $3e^2$

(C)  $e^3$

(D) does not exist

21.  $\lim_{h \rightarrow 0} \frac{\sqrt{(25+h)} - (5)}{h}$  is

(A) 0

(B) 5

(C)  $\frac{1}{5}$

(D)  $\frac{1}{10}$

(E)  $\frac{1}{25}$

22. Given  $f'(x) = \frac{1}{x}$  and  $f(2) = 5$ , write an equation for the line which is tangent to the graph of  $f(x)$  at the point where  $x = 2$ .

(A)  $y = \frac{1}{2}x - \frac{1}{2}$

(B)  $y = \frac{1}{5}x + 5$

(C)  $y = \frac{1}{2}x + 4$

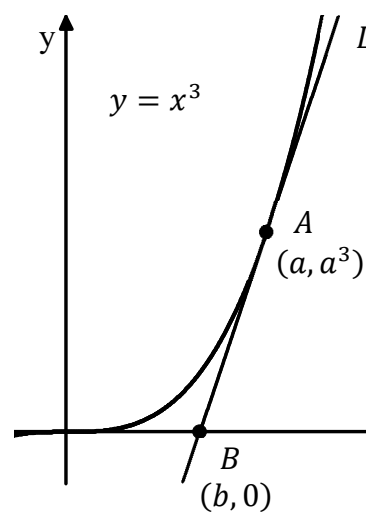
(D)  $y = \frac{1}{5}x - \frac{23}{5}$

(E)  $y = \frac{1}{2}x + 5$

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23. In the figure to the right, line L is tangent to the graph of  $y = x^3$  at point A with coordinates  $(a, a^3)$ . Line L crosses the  $x$ -axis at point B, with coordinates  $(b, 0)$ .

a. Find  $b$  in terms of  $a$ .



b. Find the value of  $b$  when  $a = 9$ .