

# Derivatives Matching!!!

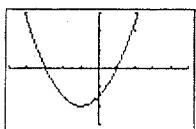
## AB Calculus AB

---

Match the graph of each function to the graph of its derivative.

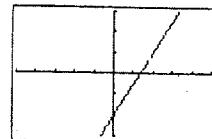
$$y = f(x)$$

1.



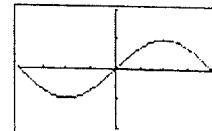
*h*

2.



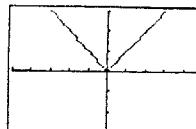
*e*

3.



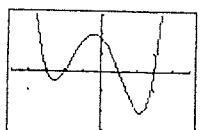
*d*

4.



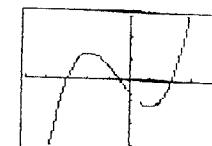
*b*

5.



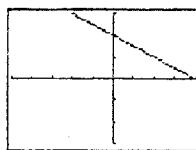
*g*

6.



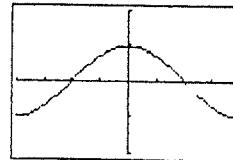
*c*

7.



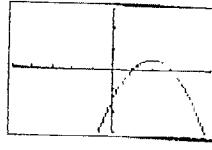
*f*

8.



*i*

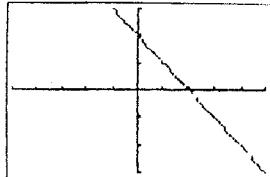
9.



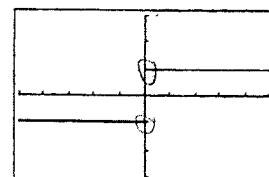
*a*

$$y = f'(x)$$

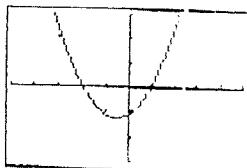
a.



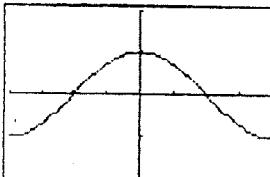
b.



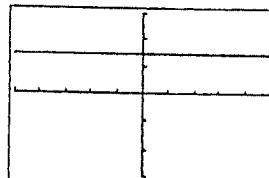
c.



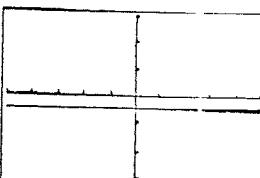
d.



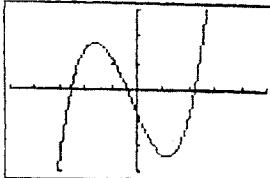
e.



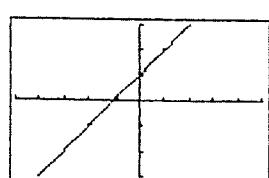
f.



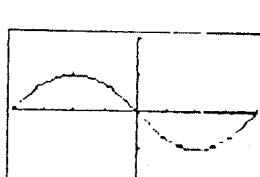
g.



h.

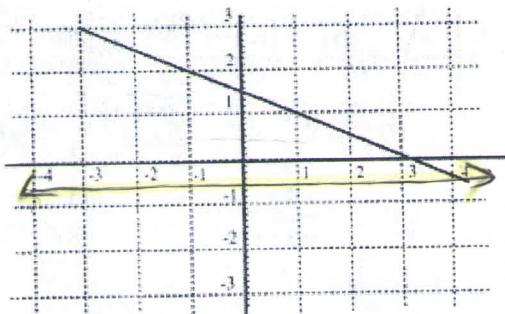


i.

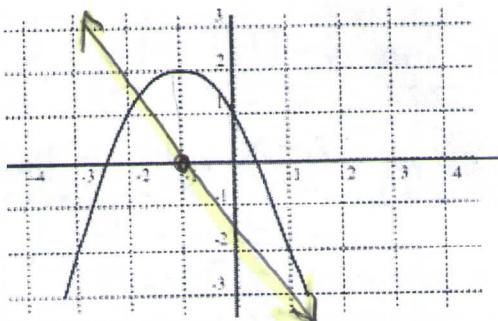


Sketch a graph of the derivative function for each of the given functions.

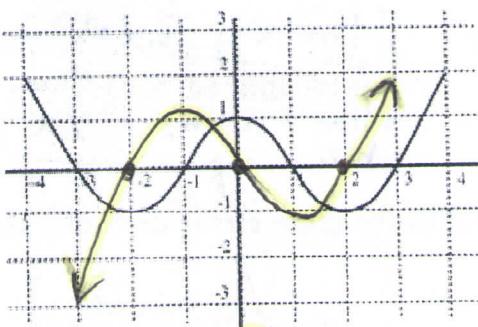
1.



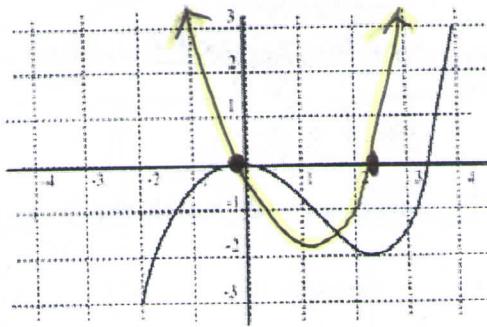
2.



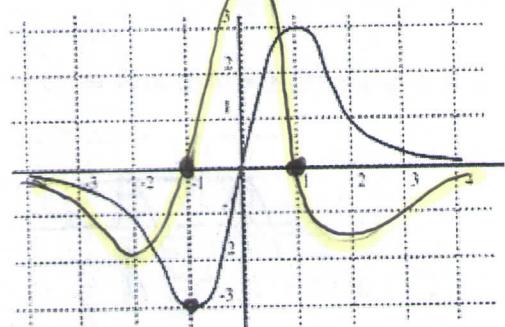
3.



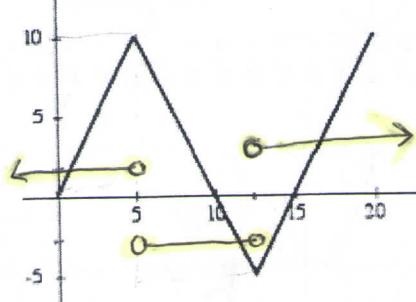
4.



5.



6.



In problems 1-2, use the definition  $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$  to find the derivative of the given function at the indicated point.

$$1. f(x) = \frac{1}{x}, x = 2$$

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{\frac{1}{x+h} - \frac{1}{x}}{h} = \lim_{h \rightarrow 0} \frac{\frac{x-(x+h)}{x(x+h)}}{h} \\ &= \lim_{h \rightarrow 0} \left( \frac{-h}{x(x+h)} \cdot \frac{1}{h} \right) = \lim_{h \rightarrow 0} \frac{-1}{x(x+h)} = \\ &= -\frac{1}{x^2} \\ f'(2) &= -\frac{1}{2^2} = \boxed{-\frac{1}{4}} \end{aligned}$$

$$2. f(x) = 3 - x^2, x = -1$$

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{3 - (x+h)^2 - (3 - x^2)}{h} \\ &= \lim_{h \rightarrow 0} \frac{3 - x^2 - 2hx - h^2 - 3 + x^2}{h} \\ &= \lim_{h \rightarrow 0} \frac{-2hx - h^2}{h} = \lim_{h \rightarrow 0} (-2x - h) \\ &= -2x \\ f'(-1) &= -2(-1) = \boxed{2} \quad 13 \end{aligned}$$

In problems 3-4, use the definition  $f'(a) = \lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$  to find the derivative of the given function at the indicated point.

3.  $f(x) = \frac{1}{x}, a = 2$

$$\begin{aligned} f'(2) &= \lim_{x \rightarrow 2} \frac{\frac{1}{x} - f(2)}{x - 2} = \lim_{x \rightarrow 2} \frac{\frac{1}{x} - \frac{1}{2}}{x - 2} \\ &= \lim_{x \rightarrow 2} \frac{\frac{2-x}{2x} + \frac{1}{x-2}}{x-2} = \lim_{x \rightarrow 2} \frac{-1}{2x} \\ &= \frac{-1}{4} = \boxed{-\frac{1}{4}} \end{aligned}$$

5. Find  $f'(x)$  if  $f(x) = 3x - 2$ .

$$\begin{aligned} \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} &= \lim_{h \rightarrow 0} \frac{3(x+h) - 2 - (3x-2)}{h} \\ &= \lim_{h \rightarrow 0} \frac{3x+3h-2-3x+2}{h} = \lim_{h \rightarrow 0} \frac{3h}{h} = \lim_{h \rightarrow 0} 3 \\ &= \boxed{3} \end{aligned}$$

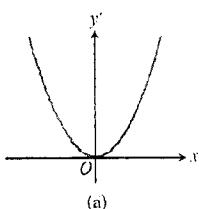
4.  $f(x) = \sqrt{x+1}, a = 3$

$$\begin{aligned} f'(3) &= \lim_{x \rightarrow 3} \frac{f(x) - f(3)}{x - 3} = \lim_{x \rightarrow 3} \frac{\sqrt{x+1} - 2}{x - 3} \\ &= \lim_{x \rightarrow 3} \frac{(\sqrt{x+1}-2)(\sqrt{x+1}+2)}{(x-3)(\sqrt{x+1}+2)} = \lim_{x \rightarrow 3} \frac{x+1-4}{(x-3)(\sqrt{x+1}+2)} \\ &= \lim_{x \rightarrow 3} \frac{1}{\sqrt{x+1}+2} = \frac{1}{2+2} = \boxed{\frac{1}{4}} \end{aligned}$$

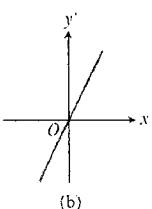
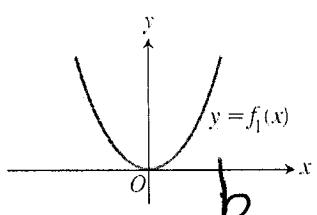
6. Find  $\frac{d}{dx}(x^2)$ .

$$\begin{aligned} \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} &= \lim_{h \rightarrow 0} \frac{(x+h)^2 - (x^2)}{h} \\ &= \lim_{h \rightarrow 0} \frac{x^2 + 2hx + h^2 - x^2}{h} = \lim_{h \rightarrow 0} \frac{2hx + h^2}{h} \\ &= \lim_{h \rightarrow 0} (2x+h) = \boxed{2x} \end{aligned}$$

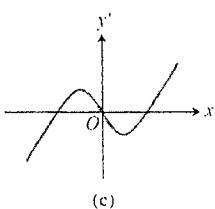
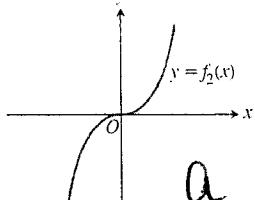
In exercises 7-10, match the graph of the function with the graph of the derivative shown below:



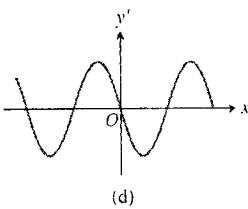
7.



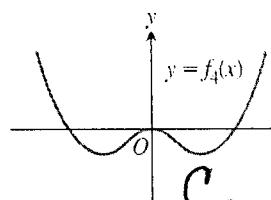
8.



9.



10.



11. If  $f(2) = 3$  and  $f'(2) = 5$ , find an equation of (a) the tangent line and (b) the normal line to the graph of  $y = f(x)$  at the point where  $x = 2$ .

$y = f(2, 3)$

$m = 5$

a)  $y - 3 = 5(x - 2)$

b)  $y - 3 = -\frac{1}{5}(x - 2)$

12. Find the lines that are (a) tangent and (b) normal to the curve  $y = x^3$  at the point  $(1, 1)$ .

pt is given slope =  $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$

$$\begin{aligned} &= \lim_{h \rightarrow 0} \frac{(x+h)^3 - x^3}{h} = \lim_{h \rightarrow 0} \frac{x^3 + 3x^2h + 3xh^2 + h^3 - x^3}{h} = \lim_{h \rightarrow 0} (3x^2 + 3xh + h^2) \end{aligned}$$

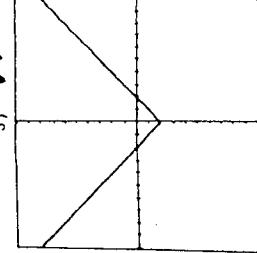
$$= 3x^2 \quad f'(1) = 3(1)^2 = 3 \quad \text{a) } y - 1 = 3(x - 1) \quad \text{b) } y - 1 = -\frac{1}{3}(x - 1)$$

and 2 10

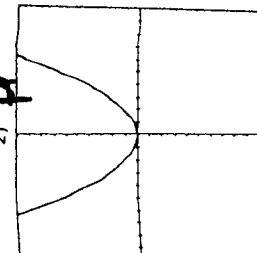
**WHAT DID THE DERIVATIVE NEAR THE  
HORIZONTAL ASYMPTOTE SHOUT TO  
THE DERIVATIVE NEAR THE VERTICAL  
ASYMPTOTE?**

Match each graph with a derivative graph on the next page.

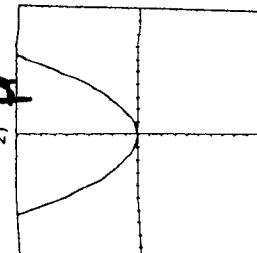
3) W



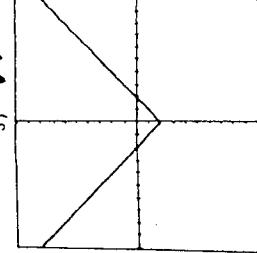
4) H



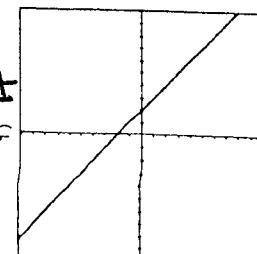
5) E



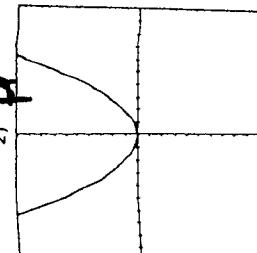
6) L



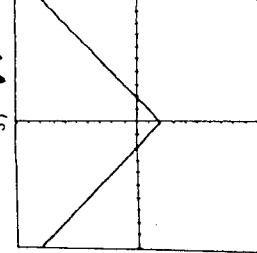
7) U



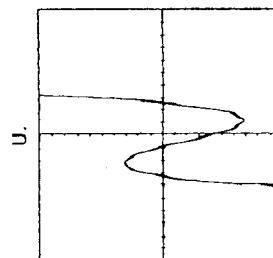
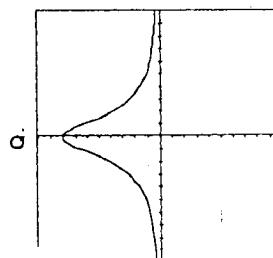
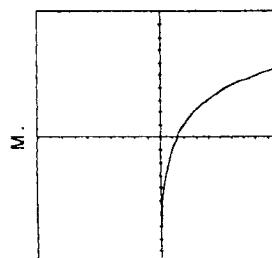
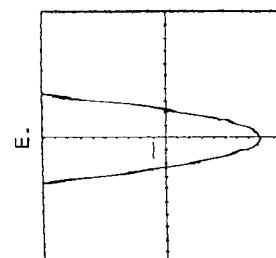
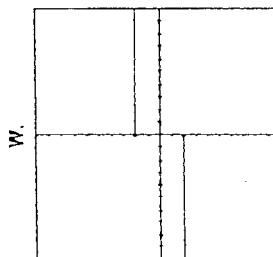
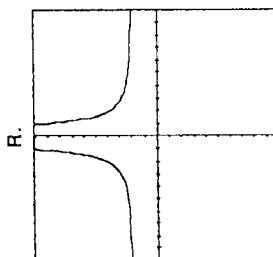
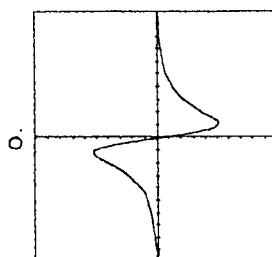
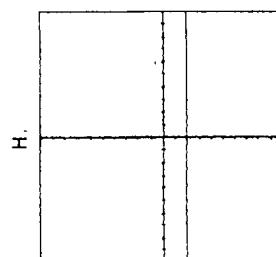
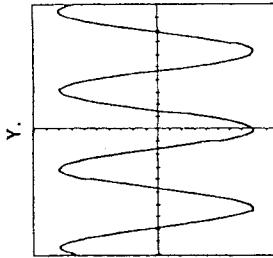
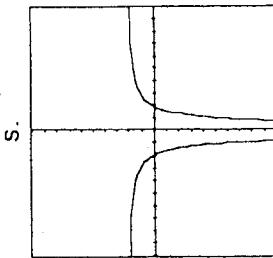
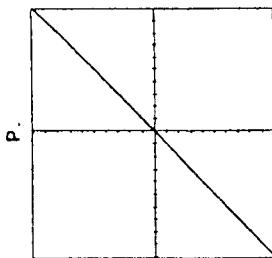
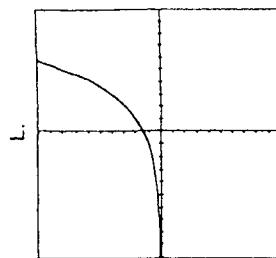
8) Y



9) S



Derivative functions.



H E Y     S L O W U P!

9	6	7	4
5	8	3	2

H E Y

1	5
---	---