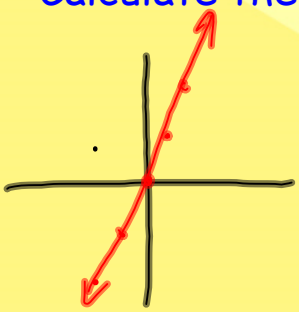
Warm Up:

Calculate the Derivatives of each of the following:



$f(x) = x^2$

$f(x) = x^2 + 5$

$f(x) = x^2 - 3$

$f'(x) = 2x$

Explain WHY the relationship of these answers makes sense (hint think about the relationship between the grahps).

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find the gradient of the tangent line at the given value of x.

1 $f(x) = 2x - 3; x = 2$

2 $f(x) = 3x^2 + 2x; x = -3$

3 $f(x) = x^2 - x + 2; x = 1$

① $f'(x) = 2$

$f'(2) = 2$

② $f(x) = 3x^2 + 2x$

$f'(x) = 6x + 2$

$f'(-3) = 6(-3) + 2$

$= -16$

③ $f(x) = x^2 - x + 2$

$f'(x) = 2x - 1$

$f'(1) = 2(1) - 1$

$= 1$

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Power rule

If $f(x) = x^n$, then $f'(x) = nx^{n-1}$, where $n \in \mathbb{R}$.

Use the power rule to find the derivative of each function.

a $f(x) = x^{12}$ **b** $f(x) = \frac{1}{x^3}$ **c** $f(x) = \sqrt{x}$

$f'(x) = 12x^{11}$

$f(x) = x^{-3}$

$f'(x) = -3x^{-4}$

or $\frac{-3}{x^4}$

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

$f'(x) = \frac{1}{2}x^{-\frac{1}{2}}$

or $\frac{1}{2\sqrt{x}}$

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Quiz 2morrow

- Derivative at a specific (given) X value
- "long way" limit definition method
- Basic short-cut power rule
- Simplify using exponents then use short-cut (HW)

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(5) $f(x) = \frac{1}{\sqrt{x}}$

$f(x) = x^{-\frac{1}{2}}$

$f'(x) = -\frac{1}{2}x^{-\frac{3}{2}}$

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(6) $f(x) = \sqrt[5]{x^3}$

$f(x) = x^{\frac{3}{5}}$

$f'(x) = \frac{3}{5}x^{-\frac{2}{5}}$

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(8) $f(x) = \frac{3}{(4x)^2} = \frac{3}{4x \cdot 4x}$

$f(x) = \frac{3}{16x^2}$

$f(x) = \frac{3}{16}x^{-2}$

$f'(x) = \frac{-6}{16}x^{-3}$

$f'(x) = \frac{-3}{8}x^{-3}$

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(9) $y = 4x^2 + 1$

$f(x) = 4x^2 + 1$

$f(x+h) = 4(x+h)^2 + 1$

$= 4(x^2 + 2xh + h^2) + 1$

$= 4x^2 + 8xh + 4h^2 + 1$

$= \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

$= \lim_{h \to 0} \frac{4x^2 + 8xh + 4h^2 + 1 - (4x^2 + 1)}{h}$

$= \lim_{h \to 0} \frac{4x^2 + 8xh + 4h^2 + 1 - 4x^2 - 1}{h}$

$= \lim_{h \to 0} \frac{8xh + 4h^2}{h}$

$= \lim_{h \to 0} \frac{h(8x + 4h)}{h}$

$= 8x + 4(0)$

$= 8x$

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