February 28

Multiply:

$(x^2 + 2xh + h^2)(x + h)$

$x^3 + x^2h + 2x^2h + 2xh^2 + h^2x + h^3$

$x^3 + 3x^2h + 3xh^2 + h^3 = (x+h)^3$

$(x^3 + 3x^2h + 3xh^2 + h^3)(x + h)$

$x^4 + 3x^3h + 3x^2h^2 + h^3x + x^3h + 3x^2h^2 + 3xh^3 + h^4$

$x^4 + h^4 + 4x^3h + 3x^2h^2 + 3x^2h^2 + 4xh^3$

$x^4 + 4x^3h + 6x^2h^2 + 4xh^3 + h^4 = (x+h)^4$

February 28

Students will verbally explain how to find derivative, using the power rule

(using the words: constant, exponent, sum...)

$f(x)=x^2$

find $f'(x)$

$2x$

$g(x)=x^3$

find $g'(x)$

$3x^2$

$h(x)=x^4$

find $h'(x)$

$4x^3$

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

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

$$\lim_{h\to 0}\frac{(x+h)^3-x^3}{h}=\lim_{h\to 0}\frac{x^3+3x^2h+3xh^2+h^3-x^3}{h}$$

$$=\lim_{h\to 0}\frac{3x^2h+3xh^2+h^3}{h}=\lim_{h\to 0}\frac{h(3x^2+3xh+h^2)}{h}$$

$$=\lim_{h\to 0}3x^2+3xh+h^2=3x^2$$

$$\lim_{h\to 0}\frac{(x+h)^4-x^4}{h}=\lim_{h\to 0}\frac{x^4+4x^3h+6x^2h^2+4xh^3+h^4-x^4}{h}$$

$$=\lim_{h\to 0}\frac{4x^3h+6x^2h^2+4xh^3+h^4}{h}=\lim_{h\to 0}\frac{h(4x^3+6x^2h+4xh^2+h^3)}{h}$$

$$=\lim_{h\to 0}4x^3+6x^2h+4xh^2+h^3=4x^3$$

Power Rule

$$\frac{d}{dx}\left(x^n\right)=nx^{n-1}$$

→ multiply by the original exponent

→ new exponent = original exponent − 1

Constant Multiple Rule

c = constant

$$\frac{d}{dx}\left(cx^n\right)=c\cdot\frac{d}{dx}\left(x^n\right)=c\left(nx^{n-1}\right)$$

Sum + Difference Rule

$$\frac{d}{dx}\left(f(x)\pm g(x)\right)=$$

$$\frac{d}{dx}\left(f(x)\right)\pm\frac{d}{dx}\left(g(x)\right)=f'(x)\pm g'(x)$$

$f(x) = 7x^9$
find $f'(x)$

$f'(x) = 7(9x^8)$
$= 63x^8$

$y = x^7 - 6x^3 + x^{\frac{1}{4}}$
find y'

$y' = 7x^6 - 6(3x^2) + \frac{1}{4}x^{-\frac{3}{4}}$
$= 7x^6 - 18x^2 + \frac{1}{4}x^{-\frac{3}{4}}$

$y = 9x^2 - 2x^{13} + 4x^1$
find $\frac{dy}{dx}$

$\frac{dy}{dx} = 9(2x) - 2(13x^{12}) + 4(1x^0)$
$= 18x - 26x^{12} + 4$

$h(x) = 6x^{-5} + 10x^0$
find $h'(x)$

$h'(x) = 6(-5x^{-6}) + 10(0x^{-1})$
$= -30x^{-6} + 0$
$= -30x^{-6}$

$\frac{d}{dx}(\text{constant}) = 0$

derivative of a number

$\frac{d}{dx}(x) = 1$

In Exercises 7–14, use the Power Rule to compute the derivative.

7. $\left.\frac{d}{dx}x^4\right|_{x=-2}$

Show Answer

8. $\left.\frac{d}{dt}t^{-3}\right|_{t=4}$

9. $\left.\frac{d}{dt}t^{2/3}\right|_{t=8}$

Show Answer

$\left.\frac{d}{dx}x^4\right|_{x=-2}$

→ take the derivative then evaluate at $x=-2$