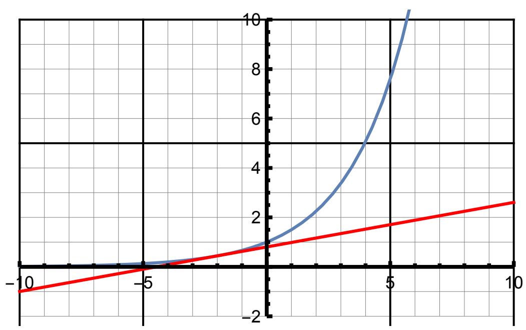
Derivative at a Point Worksheet

Corresponding to Section 1.3

1. Given that $k(x) = 1.5^x$, we want the derivative at $x = -2$.

1.1. Graph this function along with its tangent line at $x = -2$. Approximate the slope of this tangent line.

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{k'[-2], 2.6 / 15}
{0.180207, 0.173333}
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1.2. Approximate the derivative of this function at $x = 2$ to 3 decimal places by numerically evaluating the difference quotient for x-values that get progressively closer to 2.

x	2.1	2.01	2.001	2.0001	2.00001
$\frac{k(x)-k(2)}{x-2}$					

$k'(2) \approx$ ________________

x	2.1	2.01	2.001	2.0001	2.00001
$\frac{k(x)-k(2)}{x-2}$	0.931044	0.914149	0.912481	0.912315	0.912298

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k'(2) is approximately 0.912
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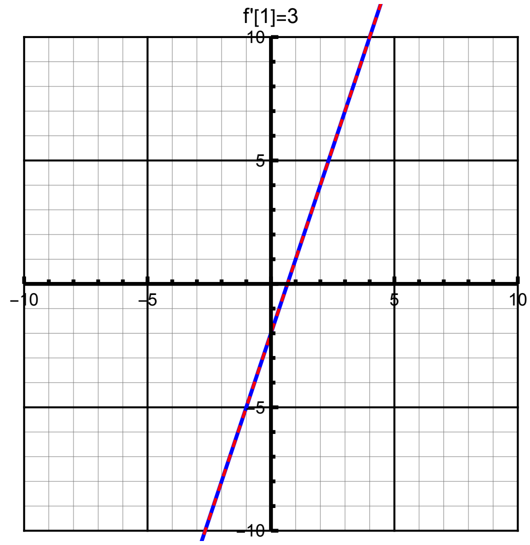
2. Given that $f(x) = 3x - 2$, we want the derivative at $x = 1$.

2.1. Graph this function along with its tangent line at $x = 1$. Identify the slope of this tangent line.



2.2. Find the derivative of this function at $x = 1$ using the limit definition.

f'(x)

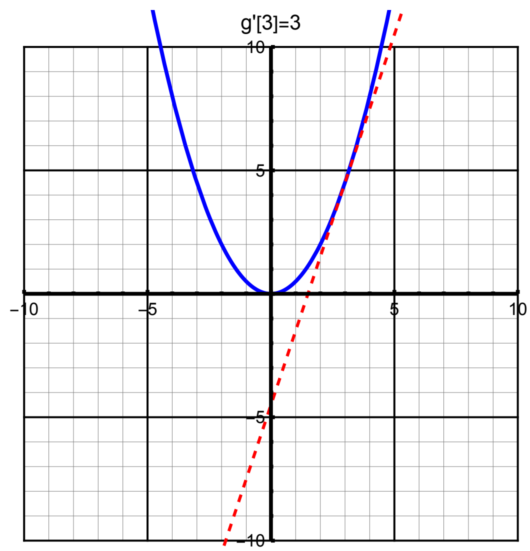
$= \lim_{h\to 0}(f(1+h) - f(1))/h$

$= \lim_{h\to 0}(3*(1+h) - 2 - (3*1 - 2))/h$

$= \lim_{h\to 0}(3\,h)/h = \lim_{h\to 0} 3 = 3$

3. Given that $g(x) = \frac{x^2}{2}$, we want the derivative at $x = 3$.

3.1. Graph this function along with its tangent line at $x = 3$. Identify the slope of this tangent line.



3.2. Find the derivative of this function at $x = 3$ using the limit definition.

g'(x)

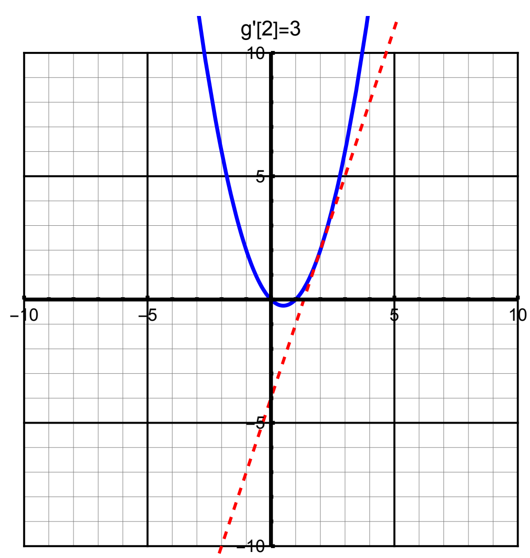
$= \lim_{h \to 0} (g(3 + h) - g(3))/h$

$= \lim_{h \to 0} ((3 + h)\text{^}2/2 - (3\text{^}2/2))/h$

$= \lim_{h \to 0} ((6h + h\text{^}2)/2)/h = \lim_{h \to 0} (3 + h/2) = 3$

4. Given that $h(x) = x^2 - x$, we want the derivative at $x = 2$.

4.1. Graph this function along with its tangent line at $x = 2$. Identify the slope of this tangent line.



4.2. Find the derivative of this function at $x = 2$ using the limit definition.

It’s a little confusing to use “h” for the function name when you’re doing derivatives by the limit definition; hence I’ll use “g”:

g’(x)
$= \lim_{h \to 0} (g(2+h) - g(2))/h$

$= \lim_{h \to 0} ((2+h)^2 - (2+h) - (2^2 - 2))/h$

$= \lim_{h \to 0} ((4h + h^2) - h)/h = \lim_{h \to 0} (3) = 3$

4.3. Find an equation for the tangent line at $x = 2$.

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Print["y=", g'[2] (x - 2) + g[2]]
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y=2 + 3 (-2 + x)