Derivatives — Power rule

Name: _____ Date: _____

Find f'(x). Bring each power down in front, and take one off the power.

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

   $f'(x) = -2 \cdot 2x - 3$
   $= -4x - 3$

2. $f(x) = -x^2 + x - 2$

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

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

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

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

Derivatives — Product rule

Name: _____ Date: _____

Find f'(x) with the product rule: u'v + uv'.

1. **f(x) = (2x − 1)(3x − 1)**

   u = 2x − 1, v = 3x − 1
   u' = 2, v' = 3
   f'(x) = 2(3x − 1) + (2x − 1)(3)
   = 6x − 2 + 6x − 3
   = 12x − 5

2. **f(x) = (−x − 2)(x + 3)**

3. **f(x) = (−3x − 3)(−2x − 1)**

4. **f(x) = (−x − 3)(−3x + 3)**

5. **f(x) = (3x + 3)(x − 3)**

6. **f(x) = (−3x − 1)(x + 2)**

Derivatives — Quotient rule

Name: _____ Date: _____

Find f'(x) with the quotient rule: u'v − uv', all over v².

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

$u = 3x - 2,\ v = x - 3$
$u' = 3,\ v' = 1$
$f'(x) = \frac{3(x - 3) - (3x - 2)(1)}{(x - 3)^2}$
$= \frac{3x - 9 - (3x - 2)}{(x - 3)^2}$
$= \frac{-7}{(x - 3)^2}$

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

3. $f(x) = \frac{-2x - 3}{2x + 1}$

4. $f(x) = \frac{-3x}{x + 2}$

5. $f(x) = \frac{-2x - 3}{x + 3}$

6. $f(x) = \frac{2x - 1}{2x + 3}$

Derivatives — Chain rule

Name: _____ Date: _____

Find f'(x) with the chain rule: the derivative of the outside, times u'.

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

   $u = -x - 3$, $u' = -1$
   $f'(x) = 2(-x - 3) \cdot (-1)$
   $= -2(-x - 3)$

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

3. $f(x) = (x + 2)^3$

4. $f(x) = (3x - 1)^3$

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

6. $f(x) = (x - 3)^3$

Name: _____ Date: _____

Find f'(x). Use the derivative of each function, and the chain rule when there is an inside.

1. **$f(x) = 3 \sin x - 5 \cos x - 3 \ln x$**

   $f'(x) = 3 \cos x + 5 \sin x - \frac{3}{x}$

2. **$f(x) = 5 \sin x + 3 \cos x + 5e^x$**

3. **$f(x) = 4 \sin x - 5 \ln x$**

4. **$f(x) = -4 \cos x - 3e^x$**

5. **$f(x) = 5 \sin x - 5e^x + \ln x$**

6. **$f(x) = 3 \sin x + 4 \cos x + 4 \ln x$**

Power Pack · The rules of differentiation — Answer key

The power rule

1. $f(x) = -2x^2 - 3x - 2 \rightarrow f'(x) = -4x - 3$
2. $f(x) = -x^2 + x - 2 \rightarrow f'(x) = -2x + 1$
3. $f(x) = -x^2 - 3x + 2 \rightarrow f'(x) = -2x - 3$
4. $f(x) = -2x^2 + x - 1 \rightarrow f'(x) = -4x + 1$
5. $f(x) = -x^2 + 2x + 2 \rightarrow f'(x) = -2x + 2$
6. $f(x) = -3x^2 - 2x - 3 \rightarrow f'(x) = -6x - 2$

The product rule

1. $f(x) = (2x - 1)(3x - 1) \rightarrow f'(x) = 12x - 5$
2. $f(x) = (-x - 2)(x + 3) \rightarrow f'(x) = -2x - 5$
3. $f(x) = (-3x - 3)(-2x - 1) \rightarrow f'(x) = 12x + 9$
4. $f(x) = (-x - 3)(-3x + 3) \rightarrow f'(x) = 6x + 6$
5. $f(x) = (3x + 3)(x - 3) \rightarrow f'(x) = 6x - 6$
6. $f(x) = (-3x - 1)(x + 2) \rightarrow f'(x) = -6x - 7$

The quotient rule

1. $f(x) = \frac{3x - 2}{x - 3} \rightarrow f'(x) = -\frac{7}{(x - 3)^2}$
2. $f(x) = \frac{2x + 1}{2x + 3} \rightarrow f'(x) = \frac{4}{(2x + 3)^2}$
3. $f(x) = \frac{-2x - 3}{2x + 1} \rightarrow f'(x) = \frac{4}{(2x + 1)^2}$
4. $f(x) = \frac{-3x}{x + 2} \rightarrow f'(x) = -\frac{6}{(x + 2)^2}$
5. $f(x) = \frac{-2x - 3}{x + 3} \rightarrow f'(x) = -\frac{3}{(x + 3)^2}$
6. $f(x) = \frac{2x - 1}{2x + 3} \rightarrow f'(x) = \frac{8}{(2x + 3)^2}$

The chain rule

1. $f(x) = (-x - 3)^2 \rightarrow f'(x) = -2(-x - 3)$
2. $f(x) = (-x + 2)^3 \rightarrow f'(x) = -3(-x + 2)^2$
3. $f(x) = (x + 2)^3 \rightarrow f'(x) = 3(x + 2)^2$
4. $f(x) = (3x - 1)^3 \rightarrow f'(x) = 9(3x - 1)^2$
5. $f(x) = (2x - 2)^3 \rightarrow f'(x) = 6(2x - 2)^2$
6. $f(x) = (x - 3)^3 \rightarrow f'(x) = 3(x - 3)^2$

sin, cos, e^x and ln

1. $f(x) = 3 \sin x - 5 \cos x - 3 \ln x \rightarrow f'(x) = 3 \cos x + 5 \sin x - \frac{3}{x}$
2. $f(x) = 5 \sin x + 3 \cos x + 5e^x \rightarrow f'(x) = 5 \cos x - 3 \sin x + 5e^x$
3. $f(x) = 4 \sin x - 5 \ln x \rightarrow f'(x) = 4 \cos x - \frac{5}{x}$
4. $f(x) = -4 \cos x - 3e^x \rightarrow f'(x) = 4 \sin x - 3e^x$

sin, cos, e^x and ln

5. $f(x) = 5\sin x - 5e^x + \ln x \rightarrow f'(x) = 5\cos x - 5e^x + \frac{1}{x}$

6. $f(x) = 3\sin x + 4\cos x + 4\ln x \rightarrow f'(x) = 3\cos x - 4\sin x + \frac{4}{x}$