

# Circuit Training – Product and Quotient Rules

Name \_\_\_\_\_

Directions: Begin in cell #1. Find the derivative. Search for your answer, and then call that cell #2. Proceed in this manner until you complete the circuit. You may need to attach additional sheets to show your best work.

Answer: $-\frac{7}{x^2}$ # <u>1</u> $y = (2x - 5)(3x + 7)$ $y' = 2(3x+7) + (2x-5)3$ $= 6x + 14 + 6x - 15$ $y' = 12x - 1$	Answer: $\frac{5x^2 + 18x + 9}{2\sqrt{x}}$ # <u>16</u> $y = \cos^2 x = (\cos x)^2$ $y' = 2(\cos x)' \cdot (-\sin x)$ $y' = -2 \sin x \cos x$
Answer: $\sec^2 x$ # <u>9</u> $y = \frac{3x+7}{x^3}$ $y' = \frac{3(x^3) - (3x+7)3x^2}{(x^3)^2}$ $y' = \frac{3x^3 - 9x^3 - 21x^2}{x^6}$ $y' = -\frac{6x^3 - 21x^2}{x^6} = -\frac{3x^2(2x+7)}{x^6}$ $y' = -\frac{3(2x+7)}{x^4}$	Answer: $-\frac{9}{(3x+7)^2}$ $y' = \frac{(-\sin x)(1+\sin x) - (1+\cos x)\cos x}{(1+\sin x)^2}$ # <u>6</u> $y = \frac{1+\cos x}{1+\sin x}$ $y' = \frac{-\sin x - \sin^2 x - \cos x - \cos^2 x}{(1+\sin x)^2}$ $y' = -\frac{1(\sin x + \cos x + \sin^2 x + \cos^2 x)}{(1+\sin x)^2}$ $y' = -\frac{(\sin x + \cos x + 1)}{(1+\sin x)^2}$
Answer: $\frac{-2x \sin x - \cos x + x^2 \cos x}{\sin^2 x}$ # <u>19</u> $y = \frac{x^2}{3x+7}$ $y' = \frac{2x(3x+7) - x^2(3)}{(3x+7)^2}$ $y' = \frac{6x^2 + 14x - 3x^2}{(3x+7)^2}$ $y' = \frac{3x^2 + 14x}{(3x+7)^2}$	Answer: $-\frac{2}{3}x^2 - \frac{11}{9}x + \frac{17}{18}$ # <u>15</u> $y = \sqrt{x}(x+3)^2$ $y' = \frac{1}{2}x^{-\frac{1}{2}}(x+3)^2 + \sqrt{x} \cdot 2(x+3)^1 \cdot 1$ $y' = \frac{1}{2\sqrt{x}}(x+3)^2 + (2x+6)\sqrt{x} \cdot \frac{2\sqrt{x}}{2\sqrt{x}}$ $y' = \frac{x^2 + 6x + 9 + 4x^2 + 12x}{2\sqrt{x}} = \frac{5x^2 + 18x + 9}{2\sqrt{x}}$
Answer: $12x - 1$ # <u>2</u> $y = \frac{2x-5}{3x+7}$ $y' = \frac{2(3x+7) - (2x-5)(3)}{(3x+7)^2}$ $y' = \frac{6x + 14 - (6x - 15)}{(3x+7)^2}$ $y' = \frac{29}{(3x+7)^2}$	Answer: $\sec x \tan x$ # <u>12</u> Given $f(5) = 3$ , $f'(5) = 3x + 7$ , $g(5) = 2x - 1$ , $g'(5) = \frac{1}{2}$ . If $h(t) = f(t) \cdot g(t)$ , calculate $h'(5)$ . $h'(t) = f'(t)g(t) + f(t)g'(t)$ $h'(5) = f'(5)g(5) + f(5)g'(5)$ $= (3x+7)(2x-1) + 3(\frac{1}{2})$ $= 6x^2 + 14x - 3x - 7 + 1.5$ $= 6x^2 + 11x - 5.5$
Answer: $\frac{-3(2x+7)}{x^4}$ # <u>10</u> $y = \frac{3x+7}{\sqrt{x}}$ $y' = \frac{3(\sqrt{x}) - (3x+7)\frac{1}{2}x^{-\frac{1}{2}}}{(\sqrt{x})^2}$ $y' = \frac{3\sqrt{x} - \frac{3x+7}{2\sqrt{x}} \cdot 2\sqrt{x}}{x \cdot 2\sqrt{x}}$ $y' = \frac{6x - (3x+7)}{2x\sqrt{x}}$ $y' = \frac{3x-7}{2x\sqrt{x}}$	Answer: $2 \sin x \cos x$ $y' = \sec^2 x$ # <u>8</u> $y = \tan x = \frac{\sin x}{\cos x}$ (HINT: Rewrite as $\frac{\sin x}{\cos x}$ ) $y' = \frac{\cos x \cdot \cos x - \sin x(-\sin x)}{\cos^2 x}$ $y' = \frac{\cos^2 x + \sin^2 x}{\cos^2 x} = \frac{1}{\cos^2 x} = \sec^2 x$

<p>Answer: <math>x(2 \cos x - x \sin x)</math></p> <p># <u>4</u> <math>y = x \sin x</math>  <math>y' = \sin x + x \cos x</math></p>	<p>Answer: <math>-2 \sin x \cos x</math></p> <p># <u>17</u> <math>y = \csc x = \frac{1}{\sin x}</math>  <math>y' = \frac{0 \cdot \sin x - 1 \cdot \cos x}{\sin^2 x} = \frac{-\cos x}{\sin x} \cdot \frac{1}{\sin x}</math>  <math>= -\cot x \csc x</math></p>
<p>Answer: <math>6x^2 + 11x - \frac{11}{2}</math></p> <p># <u>13</u> <math>y = \cot x = \frac{\cos x}{\sin x}</math>  <math>y' = \frac{-\sin x \cdot \sin x - \cos x \cos x}{\sin^2 x}</math>  <math>y' = \frac{-(\sin^2 x + \cos^2 x)}{\sin^2 x}</math>  <math>y' = \frac{-1}{\sin^2 x} = -\csc^2 x</math></p>	<p>Answer: <math>\frac{3x-7}{2x\sqrt{x}}</math></p> <p># <u>11</u> <math>y = \sec x = \frac{1}{\cos x}</math>  (HINT: Rewrite this trig function.)  <math>y' = \frac{0 \cdot \cos x - 1 \cdot (-\sin x)}{\cos^2 x}</math>  <math>y' = \frac{\sin x}{\cos^2 x} = \frac{\sin x}{\cos x} \cdot \frac{1}{\cos x} = \tan x \sec x</math></p>
<p>Answer: <math>\frac{3x^2+14x}{(3x+7)^2}</math>  <math>y' = \frac{(6x+7)(x^2) - (3x^2+7x) \cdot 2x}{(x^2)^2}</math></p> <p># <u>20</u> <math>y = \frac{3x^2+7x}{x^2}</math>  <math>y' = \frac{6x^3+7x^2 - 4x^3 - 14x^2}{x^4}</math>  <math>y' = \frac{-7x^2}{x^4}</math>  <math>y' = \frac{-7}{x^2}</math></p>	<p>Answer: <math>-\csc x \cot x</math>  <math>y' = \frac{(-2x)(\sin x) - (1-x^2)\cos x}{\sin^2 x}</math></p> <p># <u>18</u> <math>y = \frac{1-x^2}{\sin x}</math>  <math>y' = \frac{-2x \sin x - \cos x + x^2 \cos^2 x}{\sin^2 x}</math></p>
<p>Answer: <math>x \cos x + \sin x</math></p> <p># <u>5</u> <math>y = \frac{3}{3x+7}</math>  <math>y' = \frac{0(3x+7) - 3(3)}{(3x+7)^2}</math>  <math>y' = \frac{-9}{(3x+7)^2}</math></p>	<p>Answer: <math>\frac{29}{(3x+7)^2}</math></p> <p># <u>3</u> <math>y = x^2 \cos x</math>  <math>y' = 2x \cdot \cos x - x^2 \sin x</math>  <math>y' = x(2 \cos x - x \sin x)</math></p>
<p>Answer: <math>-\csc^2 x</math>  <math>k'(t) = \frac{g' \cdot f - g \cdot f'}{f^2}</math></p> <p># <u>14</u> Given <math>f(5) = 3</math>, <math>f'(5) = 3x + 7</math>,  <math>g(5) = 2x - 1</math>, <math>g'(5) = \frac{1}{2}</math>.  If <math>k(t) = \frac{g(t)}{f(t)}</math>, calculate <math>k'(5)</math>.</p> $k'(5) = \frac{\frac{1}{2} \cdot 3 - (2x-1)(3x+7)}{3^2} = \frac{\frac{3}{2} - 6x^2 - 11x + 7}{9}$ $= \frac{3 - 12x^2 - 22x + 14}{18} = \frac{-12x^2 - 22x + 17}{18}$ $= -\frac{2}{3}x^2 - \frac{11}{9}x + \frac{17}{18}$	<p>Answer: <math>-\frac{\sin x + \cos x + 1}{(1+\sin x)^2}</math></p> <p># <u>7</u> <math>y = \sin^2 x = (\sin x)^2</math>  (HINT: Rewrite as <math>\sin x \cdot \sin x</math>.)  <math>y' = 2(\sin x)' \cdot \cos x</math>  <math>y' = 2 \sin x \cos x</math></p>