Skill Builder: Topic 2.5 – Applying the Power Rule (Circuit)

Begin in the first cell marked #1 and find $\frac{dy}{dx}$ for each given function. To advance in the circuit, search for your answer and mark that cell #2. Continue in this manner until you complete the circuit. Show all pertinent work. Note: Several of these problems will require some algebraic manipulation either before or after you take the derivative.

#1 Ans: $x^4+x^3+x^2+x+1$ $y=5x^3-4x^2+9x+17$ $\frac{dy}{dx}=5\cdot 3x^2-4\cdot 2x+9$ $=15x^2-8x+9$	**12** Ans: $-\frac{1}{x^2}+\frac{6}{x^3}+75$ $y=\frac{(x-5)(x+5)}{x}$ $y=\frac{x^2-25}{x}$ $\quad \frac{dy}{dx}=1+25x^{-2}$ $y=\frac{x^2}{x}-\frac{25}{x}$ $\quad \frac{dy}{dx}=1+\frac{25}{x^2}$ $y=x-25x^{-1}$
14 Ans: $\frac{7}{6}x^{\frac{1}{6}}$ $y=k\sqrt{x}+x\sqrt{k}$. $y=kx^{1/2}+\sqrt{k}\cdot x$ $\frac{dy}{dx}=\frac{1}{2}kx^{-1/2}+\sqrt{k}$ $\frac{dy}{dx}=\frac{k}{2\sqrt{x}}+\sqrt{k}$	**4** Ans: $15x^4+8x+1$ $y=x^{-1}-x^{-2}+3x$. $\frac{dy}{dx}=-1x^{-2}-(-2)\cdot x^{-3}+3$ $=-\frac{1}{x^2}+\frac{2}{x^3}+3$
23 Ans: $1+2x$ $y=kx^2+bx+c$ $\frac{dy}{dx}=2kx+b$	**16** Ans: $\frac{1}{3x^2}+\frac{4}{3x^3}$ $y=\frac{x^3}{3}-3x^2$ $\frac{dy}{dx}=\frac{1}{3}\cdot(3)x^2-6x$ $\frac{dy}{dx}=x^2-6x$
9 Ans: $3x^2-30x+75$ $y=(x-2)(x^2+2x+4)$ $y=x^3+2x^2+4x-2x^2-4x-8$ $y=x^3-8$ $\frac{dy}{dx}=3x^2$	**21** Ans: k $y=\pi x^2$ $\frac{dy}{dx}=2\pi\cdot x$

__17__ Ans: x^2-6x

$y=(x-1)(x^2+1)$

$y=x^3-x^2+x-1$

$\frac{dy}{dx}=3x^2-2x+1$

_2_ Ans: $15x^2-8x+9$

$y=\frac{3}{4}x^4+\frac{1}{2}x^2$

$\frac{dy}{dx}=\frac{3}{4}\cdot 4x^3+\frac{1}{2}\cdot 2x$

$=3x^3+x$

__5__ Ans: $-\frac{1}{x^2}+\frac{2}{x^3}+3$

$y=\sqrt{x}+\sqrt[3]{x}$

$y=x^{1/2}+x^{1/3}$

$\frac{dy}{dx}=\frac{1}{2}\cdot x^{-1/2}+\frac{1}{3}\cdot x^{-2/3}$

$=\frac{1}{2\sqrt{x}}+\frac{1}{3\sqrt[3]{x^2}}$

__19__ Ans: $\frac{x^2-1}{x^2}$

$y=\frac{1}{\sqrt{x}}+\sqrt{x}$

$y=x^{-1/2}+x^{1/2}$

$\frac{dy}{dx}=-\frac{1}{2}x^{-3/2}+\frac{1}{2}x^{-1/2}$

$\frac{dy}{dx}=-\frac{1}{2x^{3/2}}+\frac{1}{2x^{1/2}}=-\frac{1}{2\sqrt{x^3}}+\frac{1}{2\sqrt{x}}$

__18__ Ans: $3x^2-2x+1$

$y=\frac{1+x^2}{x}$

$y=\frac{1}{x}+\frac{x^2}{x}$

$y=x^{-1}+x$

$\frac{dy}{dx}=-x^{-2}+1$

$\frac{dy}{dx}=-\frac{1}{x^2}+1$

$\frac{dy}{dx}=\frac{-1+x^2}{x^2}=\frac{x^2-1}{x^2}$

__3__ Ans: $3x^3+x$

$y=3x^5+4x^2+x$

$\frac{dy}{dx}=3\cdot 5x^4+4\cdot 2x+1$

$=15x^4+8x+1$

__10__ Ans: $3x^2$

$y=3x(x+5)^2$

$y=3x(x^2+10x+25)$

$y=3x^3+30x^2+75x$

$\frac{dy}{dx}=9x^2+60x+75$

__24__ Ans: $2kx+b$

$y=\frac{x^5}{5}+\frac{x^4}{4}+\frac{x^3}{3}+\frac{x^2}{2}+x+1$

$\frac{dy}{dx}=5\cdot\frac{x^4}{5}+4\cdot\frac{x^3}{3}+3\cdot\frac{x^2}{3}+2\cdot\frac{x^1}{2}+1+0$

$\frac{dy}{dx}=x^4+x^3+x^2+x+1$

__22__ Ans: $2\pi x$

$y = \dfrac{x^{-2} + x^{-1}}{x^{-3}}$

$y = \dfrac{x^{-2}}{x^{-3}} + \dfrac{x^{-1}}{x^{-3}}$

$y = x + x^2$

$\dfrac{dy}{dx} = 1 + 2x$

_8_ Ans: $2x + 8$

$y = (x-5)^3$

$y = 1 \cdot x^3 (-5)^0 + 3 \cdot x^2 (-5)^1 + 3 \cdot x^1 (-5)^2 + 1 \cdot x^0 (-5)^3$

$y = x^3 - 15x^2 + 75x - 125$

$\dfrac{dy}{dx} = 3x^2 - 30x + 75$

_6_ Ans: $\dfrac{1}{2\sqrt{x}} + \dfrac{1}{3\sqrt[3]{x^2}}$

$y = x\sqrt{x} + 8x^{-1}$

$y = x \cdot x^{1/2} + 8x^{-1} = x^{3/2} + 8x^{-1}$

$\dfrac{dy}{dx} = \dfrac{3}{2} \cdot x^{1/2} + 8 \cdot (-1) x^{-2}$

$= \dfrac{3\sqrt{x}}{2} - \dfrac{8}{x^2}$

__20__ Ans: $\dfrac{-1}{2\sqrt{x^3}} + \dfrac{1}{2\sqrt{x}}$

$y = kx + b$

$\dfrac{dy}{dx} = k$

__15__ Ans: $\dfrac{k}{2\sqrt{x}} + \sqrt{k}$

$y = \dfrac{3x^2 - x - 2}{3x^2}$

$y = \dfrac{3x^2}{3x^2} - \dfrac{x}{3x^2} - \dfrac{2}{3x^2}$

$y = 1 - \dfrac{1}{3x} - \dfrac{2}{3x^2}$

$y = 1 - \dfrac{1}{3}x^{-1} - \dfrac{2}{3}x^{-2}$

$\dfrac{dy}{dx} = \dfrac{1}{3}x^{-2} + \dfrac{4}{3}x^{-3}$

$\dfrac{dy}{dx} = \dfrac{1}{3x^2} + \dfrac{4}{3x^3}$

__13__ Ans: $1 + \dfrac{25}{x^2}$

$y = x^{\frac{1}{2}} \cdot x^{\frac{2}{3}}$

$y = x^{\frac{1}{2} + \frac{2}{3}}$

$y = x^{\frac{3}{6} + \frac{4}{6}}$

$y = x^{\frac{7}{6}}$

$\dfrac{dy}{dx} = \dfrac{7}{6}x^{1/6}$

__11__ Ans: $9x^2 + 60x + 75$

$y = \dfrac{1}{x} - \dfrac{3}{x^2} + 75x$

$y = x^{-1} - 3x^{-2} + 75x$

$\dfrac{dy}{dx} = -x^{-2} - 3(-2)x^{-3} + 75$

$\dfrac{dy}{dx} = -\dfrac{1}{x^2} + \dfrac{6}{x^3} + 75$

_7_ Ans: $\dfrac{3\sqrt{x}}{2} - \dfrac{8}{x^2}$

$y = (x+4)^2$

$y = (x+4)(x+4)$

$y = x^2 + 8x + 16$

$\dfrac{dy}{dx} = 2x + 8$