Topic: Chain rule with trig, log, and exponential functions

Question: Find the derivative of the trigonometric function.

$$y = \sin(3x^2 + 11x)$$

Answer choices:

A $\quad y' = -(6x + 11)\cos(3x^2 + 11x)$

B $\quad y' = -(6x + 11)\sin(3x^2 + 11x)$

C $\quad y' = (6x + 11)\cos(3x^2 + 11x)$

D $\quad y' = (6x + 11)\sin(3x^2 + 11x)$

Solution: C

Set $u = 3x^2 + 11x$ and $u' = 6x + 11$. Then $y = \sin u$, and the derivative is

$$y' = \cos u \cdot u'$$

$$y' = \cos(3x^2 + 11x) \cdot (6x + 11)$$

$$y' = (6x + 11)\cos(3x^2 + 11x)$$

Topic: Chain rule with trig, log, and exponential functions

Question: Find the derivative of the exponential function.

$$y = e^{\sqrt{x+1}}$$

Answer choices:

A $\qquad y' = \dfrac{e^{\sqrt{x+1}}}{2\sqrt{x+1}}$

B $\qquad y' = \dfrac{e^{\sqrt{x}}}{2\sqrt{x+1}}$

C $\qquad y' = \dfrac{e^{\sqrt{x+1}}}{\sqrt{x+1}}$

D $\qquad y' = e^{\sqrt{x+1}}$

Solution: A

Make a substitution, letting $u = \sqrt{x + 1}$ and

$$u' = \frac{1}{2\sqrt{x + 1}}$$

Then the function is

$$y = e^u$$

and the derivative is

$$y' = e^u \cdot u'$$

$$y' = e^{\sqrt{x + 1}} \cdot \frac{1}{2\sqrt{x + 1}}$$

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

Topic: Chain rule with trig, log, and exponential functions

Question: Find the derivative of the logarithmic function.

$$y = \ln(x^2 - 5x)$$

Answer choices:

A $\quad y' = \dfrac{2x + 5}{x^2 + 5x}$

B $\quad y' = \dfrac{2x - 5}{x^2 - 5}$

C $\quad y' = \dfrac{5 - 2x}{x^2 - 5x}$

D $\quad y' = \dfrac{2x - 5}{x^2 - 5x}$

Solution: D

Let $u = x^2 - 5x$ and $u' = 2x - 5$. Then the function is

$$y = \ln u$$

and the derivative is

$$y' = \frac{1}{u} \cdot u'$$

$$y' = \frac{1}{x^2 - 5x} \cdot (2x - 5)$$

$$y' = \frac{2x - 5}{x^2 - 5x}$$