**Advanced Derivative Rules - Advanced**

- 1** Find the derivative $f'(x)$ using the product, chain, and natural exponential rules.
if $y = f(g(x))$, $y' = f'(g(x)) \cdot g'(x)$
[12pt] $f(x) = (2x - 4)^2 (3e^x)$

A $f'(x) = 4(2x - 4) (3e^x) - (2x - 4)^2 (3e^x)$

B $f'(x) = 4(2x - 4) (3e^x)$

C $f'(x) = (2x - 4)^2 (3e^x)$

D $f'(x) = 4(2x - 4) (3e^x) + (2x - 4)^2 (3e^x)$

- 2** Find the derivative $f'(x)$ using the product, chain, and general exponential rules.
if $h(x) = f(x) g(x)$, $h'(x) = f'(x) g(x) + f(x) g'(x)$
[12pt] $f(x) = \sqrt[3]{(x + 4)} (7^x)$

A $f'(x) = \frac{1}{3} (x + 4)^{-\frac{2}{3}} (7^x)$

B $f'(x) = \sqrt[3]{(x + 4)} (7^x \ln 7)$

C $f'(x) = \frac{1}{3} (x + 4)^{-\frac{2}{3}} (7^x) + \sqrt[3]{(x + 4)} (7^x \ln 7)$

D $f'(x) = \frac{1}{3} (x + 4)^{-\frac{2}{3}} (7^x \ln 7)$

- 3** Find the derivative $f'(x)$ using the product, chain, and natural exponential rules.

$$f(x) = (2x^2 + 5)^3 (4e^x)$$

A $f'(x) = 3(2x^2 + 5)^2 (4x) (4e^x)$

B $f'(x) = (2x^2 + 5)^3 (4e^x)$

C $f'(x) = 3(2x^2 + 5)^2 (4x) (4e^x) + (2x^2 + 5)^3 (4e^x)$

D $f'(x) = 3(2x^2 + 5)^2 (4x) (4e^x) - (2x^2 + 5)^3 (4e^x)$

- 4** Find the derivative $f'(x)$ using the product, chain, and trigonometric rules.

$$f(x) = (2x - 3)^2 (4 \sin(x))$$

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

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

C $f'(x) = 4(2x - 3) (4 \sin(x)) + (2x - 3)^2 (4 \cos(x))$

D $f'(x) = (2x - 3)^2 (4 \cos(x))$

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- 5 Find the derivative $f'(x)$ using the product, chain, and general exponential rules.

$$f(x) = \frac{1}{(2x+5)} (3 \cdot 8^x)$$

A

$$f'(x) = -2(2x+5)^{-2} (3 \cdot 8^x) + \frac{1}{(2x+5)} (3 \cdot 8^x \ln 8)$$

B

$$f'(x) = -2(2x+5)^{-2} (3 \cdot 8^x \ln 8)$$

C

$$f'(x) = -2(2x+5)^{-2} (3 \cdot 8^x)$$

D

$$f'(x) = \frac{1}{(2x+5)} (3 \cdot 8^x \ln 8)$$

- 6 Find the derivative $f'(x)$ using the product, chain, and trigonometric rules.

$$\frac{d}{dx} \sin(x) = \cos(x)$$

$$[12pt] f(x) = \frac{1}{(3x+2)} (4 \sin(x))$$

A

$$f'(x) = \frac{1}{(3x+2)} (4 \cos(x))$$

B

$$f'(x) = -3(3x+2)^{-2} (4 \cos(x))$$

C

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

D

$$f'(x) = -3(3x+2)^{-2} (4 \sin(x))$$



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- 7** Find the derivative $f'(x)$ using the quotient, chain, and natural exponential rules.

$$\text{if } h(x) = \frac{f(x)}{g(x)}, \quad h'(x) = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

$$[12pt]f(x) = \frac{(x+2)^{-2}}{4e^x}$$

A
$$f'(x) = \frac{-2(x+2)^{-3}(4e^x) + (x+2)^{-2}(4e^x)}{(4e^x)^2}$$

B
$$f'(x) = \frac{(x+2)^{-2}(4e^x) - -2(x+2)^{-3}(4e^x)}{(4e^x)^2}$$

C
$$f'(x) = \frac{-2(x+2)^{-3}(4e^x) - (x+2)^{-2}(4e^x)}{4e^x}$$

D
$$f'(x) = \frac{-2(x+2)^{-3}(4e^x) - (x+2)^{-2}(4e^x)}{(4e^x)^2}$$

- 8** Find the derivative $f'(x)$ using the quotient, chain, and natural exponential rules.

$$f(x) = \frac{(x-5)^{\frac{1}{3}}}{4e^x}$$

A
$$f'(x) = \frac{\frac{1}{3}(x-5)^{-\frac{2}{3}}(4e^x) - (x-5)^{\frac{1}{3}}(4e^x)}{4e^x}$$

B
$$f'(x) = \frac{\frac{1}{3}(x-5)^{-\frac{2}{3}}(4e^x) - (x-5)^{\frac{1}{3}}(4e^x)}{(4e^x)^2}$$

C
$$f'(x) = \frac{\frac{1}{3}(x-5)^{-\frac{2}{3}}(4e^x) + (x-5)^{\frac{1}{3}}(4e^x)}{(4e^x)^2}$$

D
$$f'(x) = \frac{(x-5)^{\frac{1}{3}}(4e^x) - \frac{1}{3}(x-5)^{-\frac{2}{3}}(4e^x)}{(4e^x)^2}$$

- 9** Find the derivative $f'(x)$ using the quotient, chain, and general exponential rules.

$$\text{if } y = f(g(x)), \quad y' = f'(g(x)) \cdot g'(x)$$

$$[12pt]f(x) = \frac{\frac{1}{(3x+4)^2}}{5 \cdot 3^x}$$

A
$$f'(x) = \frac{-6(3x+4)^{-3}(5 \cdot 3^x) - \frac{1}{(3x+4)^2}(5 \cdot 3^x \ln 3)}{5 \cdot 3^x}$$

B
$$f'(x) = \frac{-6(3x+4)^{-3}(5 \cdot 3^x) + \frac{1}{(3x+4)^2}(5 \cdot 3^x \ln 3)}{(5 \cdot 3^x)^2}$$

C
$$f'(x) = \frac{-6(3x+4)^{-3}(5 \cdot 3^x) - \frac{1}{(3x+4)^2}(5 \cdot 3^x \ln 3)}{(5 \cdot 3^x)^2}$$

D
$$f'(x) = \frac{\frac{1}{(3x+4)^2}(5 \cdot 3^x \ln 3) - -6(3x+4)^{-3}(5 \cdot 3^x)}{(5 \cdot 3^x)^2}$$

- 10** Find the derivative $f'(x)$ using the quotient, chain, and trigonometric rules.

$$\frac{d}{dx} \cos(x) = -\sin(x)$$

$$[12pt]f(x) = \frac{\frac{1}{(x-3)}}{\cos(x)}$$

A
$$f'(x) = \frac{\frac{1}{(x-3)}(-\sin(x)) - -(x-3)^{-2}(\cos(x))}{(\cos(x))^2}$$

B
$$f'(x) = \frac{-(x-3)^{-2}(\cos(x)) - \frac{1}{(x-3)}(-\sin(x))}{(\cos(x))^2}$$

C
$$f'(x) = \frac{-(x-3)^{-2}(\cos(x)) - \frac{1}{(x-3)}(-\sin(x))}{\cos(x)}$$

D
$$f'(x) = \frac{-(x-3)^{-2}(\cos(x)) + \frac{1}{(x-3)}(-\sin(x))}{(\cos(x))^2}$$

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11 Find the derivative $f'(x)$ using the quotient, chain, and general exponential rules.

$$f(x) = \frac{\sqrt{(3x-2)}}{3 \cdot 2^x}$$

A

$$f'(x) = \frac{\frac{3}{2}(3x-2)^{-\frac{1}{2}}(3 \cdot 2^x) - \sqrt{(3x-2)}(3 \cdot 2^x \ln 2)}{(3 \cdot 2^x)^2}$$

B

$$f'(x) = \frac{\frac{3}{2}(3x-2)^{-\frac{1}{2}}(3 \cdot 2^x) + \sqrt{(3x-2)}(3 \cdot 2^x \ln 2)}{(3 \cdot 2^x)^2}$$

C

$$f'(x) = \frac{\frac{3}{2}(3x-2)^{-\frac{1}{2}}(3 \cdot 2^x) - \sqrt{(3x-2)}(3 \cdot 2^x \ln 2)}{3 \cdot 2^x}$$

D

$$f'(x) = \frac{\sqrt{(3x-2)}(3 \cdot 2^x \ln 2) - \frac{3}{2}(3x-2)^{-\frac{1}{2}}(3 \cdot 2^x)}{(3 \cdot 2^x)^2}$$

12 Find the derivative $f'(x)$ using the quotient, chain, and trigonometric rules.

$$f(x) = \frac{(3x-3)^3}{5 \cos(x)}$$

A

$$f'(x) = \frac{9(3x-3)^2(5 \cos(x)) - (3x-3)^3(-5 \sin(x))}{5 \cos(x)}$$

B

$$f'(x) = \frac{(3x-3)^3(-5 \sin(x)) - 9(3x-3)^2(5 \cos(x))}{(5 \cos(x))^2}$$

C

$$f'(x) = \frac{9(3x-3)^2(5 \cos(x)) - (3x-3)^3(-5 \sin(x))}{(5 \cos(x))^2}$$

D

$$f'(x) = \frac{9(3x-3)^2(5 \cos(x)) + (3x-3)^3(-5 \sin(x))}{(5 \cos(x))^2}$$



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- 13** Find the derivative $f'(x)$ using the chain, natural exponential, and trigonometric rules.

$$\frac{d}{dx} \sin(x) = \cos(x)$$

$$[12pt] f(x) = (5e^x + 2\sin(x))^3$$

A

$$f'(x) = 3(5e^x + 2\sin(x))^3 \cdot (5e^x + 2\cos(x))$$

B

$$f'(x) = 3(5e^x + 2\sin(x))^2$$

C

$$f'(x) = 3(5e^x + 2\sin(x))^2 \cdot (5e^x + 2\cos(x))$$

D

$$f'(x) = (5e^x + 2\sin(x))^2 \cdot (5e^x + 2\cos(x))$$

- 14** Find the derivative $f'(x)$ using the chain, natural exponential, and general exponential rules.

$$\frac{d}{dx} e^x = e^x$$

$$[12pt] f(x) = (5e^x + 7^x)^{-2}$$

A

$$f'(x) = -2(5e^x + 7^x)^{-2} \cdot (5e^x + 7^x \ln 7)$$

B

$$f'(x) = (5e^x + 7^x)^{-3} \cdot (5e^x + 7^x \ln 7)$$

C

$$f'(x) = -2(5e^x + 7^x)^{-3}$$

D

$$f'(x) = -2(5e^x + 7^x)^{-3} \cdot (5e^x + 7^x \ln 7)$$

- 15** Find the derivative $f'(x)$ using the chain, natural exponential, and trigonometric rules.

$$f(x) = (5e^x + 4\sin(x))^{-1}$$

A

$$f'(x) = -(5e^x + 4\sin(x))^{-1} \cdot (5e^x + 4\cos(x))$$

B

$$f'(x) = (5e^x + 4\sin(x))^{-2} \cdot (5e^x + 4\cos(x))$$

C

$$f'(x) = -(5e^x + 4\sin(x))^{-2}$$

D

$$f'(x) = -(5e^x + 4\sin(x))^{-2} \cdot (5e^x + 4\cos(x))$$

- 16** Find the derivative $f'(x)$ using the product, natural exponential, and trigonometric rules.

$$f(x) = (3e^x)(2\cos(x))$$

A

$$f'(x) = (3e^x)(2\cos(x)) + (3e^x)(-2\sin(x))$$

B

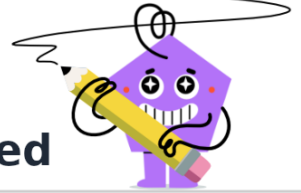
$$f'(x) = (3e^x)(2\cos(x)) - (3e^x)(-2\sin(x))$$

C

$$f'(x) = (3e^x)(-2\sin(x))$$

D

$$f'(x) = (3e^x)(2\cos(x))$$

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17 Find the derivative $f'(x)$ using the chain, general exponential, and trigonometric rules.

$$\text{if } y = f(g(x)), \quad y' = f'(g(x)) \cdot g'(x)$$
$$[12pt] f(x) = (4 \cdot 5^x + 2 \cos(x))^4$$

A

$$f'(x) = 4(4 \cdot 5^x + 2 \cos(x))^4 \cdot (4 \cdot 5^x \ln 5 - 2 \sin(x))$$

B

$$f'(x) = (4 \cdot 5^x + 2 \cos(x))^3 \cdot (4 \cdot 5^x \ln 5 - 2 \sin(x))$$

C

$$f'(x) = 4(4 \cdot 5^x + 2 \cos(x))^3$$

D

$$f'(x) = 4(4 \cdot 5^x + 2 \cos(x))^3 \cdot (4 \cdot 5^x \ln 5 - 2 \sin(x))$$

18 Find the derivative $f'(x)$ using the chain, general exponential, and trigonometric rules.

$$f(x) = \frac{1}{(4 \cdot 7^x + 5 \cos(x))^2}$$

A

$$f'(x) = -2(4 \cdot 7^x + 5 \cos(x))^{-2} \cdot (4 \cdot 7^x \ln 7 - 5 \sin(x))$$

B

$$f'(x) = -2(4 \cdot 7^x + 5 \cos(x))^{-3}$$

C

$$f'(x) = (4 \cdot 7^x + 5 \cos(x))^{-3} \cdot (4 \cdot 7^x \ln 7 - 5 \sin(x))$$

D

$$f'(x) = -2(4 \cdot 7^x + 5 \cos(x))^{-3} \cdot (4 \cdot 7^x \ln 7 - 5 \sin(x))$$

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- 19** Find the derivative $f'(x)$ using the chain, natural exponential, and general exponential rules.

$$f(x) = \sqrt[3]{(e^x + 2 \cdot 9^x)}$$

A
$$f'(x) = \frac{1}{3}(e^x + 2 \cdot 9^x)^{\frac{1}{3}} \cdot (e^x + 2 \cdot 9^x \ln 9)$$

B
$$f'(x) = \frac{1}{3}(e^x + 2 \cdot 9^x)^{-\frac{2}{3}} \cdot (e^x + 2 \cdot 9^x \ln 9)$$

C
$$f'(x) = \frac{1}{3}(e^x + 2 \cdot 9^x)^{-\frac{2}{3}}$$

D
$$f'(x) = (e^x + 2 \cdot 9^x)^{-\frac{2}{3}} \cdot (e^x + 2 \cdot 9^x \ln 9)$$

- 20** Find the derivative $f'(x)$ using the product, natural exponential, and trigonometric rules.

$$\frac{d}{dx} e^x = e^x$$

[12pt] $f(x) = (4e^x)(3 \sin(x))$

A
$$f'(x) = (4e^x)(3 \sin(x)) + (4e^x)(3 \cos(x))$$

B
$$f'(x) = (4e^x)(3 \sin(x))$$

C
$$f'(x) = (4e^x)(3 \cos(x))$$

D
$$f'(x) = (4e^x)(3 \sin(x)) - (4e^x)(3 \cos(x))$$

- 21** Find the derivative $f'(x)$ using the product, general exponential, and trigonometric rules.
if $h(x) = f(x)g(x)$, $h'(x) = f'(x)g(x) + f(x)g'(x)$
[12pt] $f(x) = (7^x)(2 \sin(x))$

A
$$f'(x) = (7^x \ln 7)(2 \cos(x))$$

B
$$f'(x) = (7^x \ln 7)(2 \sin(x))$$

C
$$f'(x) = (7^x \ln 7)(2 \sin(x)) + (7^x)(2 \cos(x))$$

D
$$f'(x) = (7^x)(2 \cos(x))$$

- 22** Find the derivative $f'(x)$ using the product, natural exponential, and general exponential rules.
if $h(x) = f(x)g(x)$, $h'(x) = f'(x)g(x) + f(x)g'(x)$
[12pt] $f(x) = (e^x)(3 \cdot 2^x)$

A
$$f'(x) = (e^x)(3 \cdot 2^x) + (e^x)(3 \cdot 2^x \ln 2)$$

B
$$f'(x) = (e^x)(3 \cdot 2^x \ln 2)$$

C
$$f'(x) = (e^x)(3 \cdot 2^x)$$

D
$$f'(x) = (e^x)(3 \cdot 2^x) - (e^x)(3 \cdot 2^x \ln 2)$$



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23 Find the derivative $f'(x)$ using the product, general exponential, and trigonometric rules.

$$f(x) = (5 \cdot 6^x) (4 \sin(x))$$

- | | |
|---|---|
| A | $f'(x) = (5 \cdot 6^x) (4 \cos(x))$ |
| B | $f'(x) = (5 \cdot 6^x \ln 6) (4 \cos(x))$ |
| C | $f'(x) = (5 \cdot 6^x \ln 6) (4 \sin(x))$ |
| D | $f'(x) = (5 \cdot 6^x \ln 6) (4 \sin(x)) + (5 \cdot 6^x) (4 \cos(x))$ |

24 Find the derivative $f'(x)$ using the product, natural exponential, and general exponential rules.

$$f(x) = (3e^x) (2 \cdot 3^x)$$

- | | |
|---|---|
| A | $f'(x) = (3e^x) (2 \cdot 3^x) - (3e^x) (2 \cdot 3^x \ln 3)$ |
| B | $f'(x) = (3e^x) (2 \cdot 3^x)$ |
| C | $f'(x) = (3e^x) (2 \cdot 3^x \ln 3)$ |
| D | $f'(x) = (3e^x) (2 \cdot 3^x) + (3e^x) (2 \cdot 3^x \ln 3)$ |

25 Find the derivative $f'(x)$ using the quotient, natural exponential, and trigonometric rules.

$$\text{if } h(x) = \frac{f(x)}{g(x)}, \quad h'(x) = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

$$[12pt] f(x) = \frac{3e^x}{5 \cos(x)}$$

- | | |
|---|--|
| A | $f'(x) = \frac{(3e^x) (5 \cos(x)) - (3e^x) (-5 \sin(x))}{5 \cos(x)}$ |
| B | $f'(x) = \frac{(3e^x) (5 \cos(x)) + (3e^x) (-5 \sin(x))}{(5 \cos(x))^2}$ |
| C | $f'(x) = \frac{(3e^x) (5 \cos(x)) - (3e^x) (-5 \sin(x))}{(5 \cos(x))^2}$ |
| D | $f'(x) = \frac{(3e^x) (-5 \sin(x)) - (3e^x) (5 \cos(x))}{(5 \cos(x))^2}$ |

26 Find the derivative $f'(x)$ using the quotient, natural exponential, and trigonometric rules.

$$f(x) = \frac{4e^x}{\cos(x)}$$

- | | |
|---|--|
| A | $f'(x) = \frac{(4e^x) (-\sin(x)) - (4e^x) (\cos(x))}{(\cos(x))^2}$ |
| B | $f'(x) = \frac{(4e^x) (\cos(x)) - (4e^x) (-\sin(x))}{(\cos(x))^2}$ |
| C | $f'(x) = \frac{(4e^x) (\cos(x)) - (4e^x) (-\sin(x))}{\cos(x)}$ |
| D | $f'(x) = \frac{(4e^x) (\cos(x)) + (4e^x) (-\sin(x))}{(\cos(x))^2}$ |



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27 Find the derivative $f'(x)$ using the quotient, general exponential, and trigonometric rules.

$$\text{if } h(x) = \frac{f(x)}{g(x)}, \quad h'(x) = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

$$[12pt] f(x) = \frac{4^x}{3 \sin(x)}$$

A
$$f'(x) = \frac{(4^x \ln 4)(3 \sin(x)) - (4^x)(3 \cos(x))}{3 \sin(x)}$$

B
$$f'(x) = \frac{(4^x \ln 4)(3 \sin(x)) - (4^x)(3 \cos(x))}{(3 \sin(x))^2}$$

C
$$f'(x) = \frac{(4^x)(3 \cos(x)) - (4^x \ln 4)(3 \sin(x))}{(3 \sin(x))^2}$$

D
$$f'(x) = \frac{(4^x \ln 4)(3 \sin(x)) + (4^x)(3 \cos(x))}{(3 \sin(x))^2}$$

28 Find the derivative $f'(x)$ using the quotient, natural exponential, and general exponential rules.

$$\frac{d}{dx} e^x = e^x$$

$$[12pt] f(x) = \frac{3e^x}{3^x}$$

A
$$f'(x) = \frac{(3e^x)(3^x) - (3e^x)(3^x \ln 3)}{(3^x)^2}$$

B
$$f'(x) = \frac{(3e^x)(3^x) - (3e^x)(3^x \ln 3)}{3^x}$$

C
$$f'(x) = \frac{(3e^x)(3^x \ln 3) - (3e^x)(3^x)}{(3^x)^2}$$

D
$$f'(x) = \frac{(3e^x)(3^x) + (3e^x)(3^x \ln 3)}{(3^x)^2}$$

29 Find the derivative $f'(x)$ using the quotient, general exponential, and trigonometric rules.

$$f(x) = \frac{5 \cdot 2^x}{4 \cos(x)}$$

A
$$f'(x) = \frac{(5 \cdot 2^x \ln 2)(4 \cos(x)) - (5 \cdot 2^x)(-4 \sin(x))}{4 \cos(x)}$$

B
$$f'(x) = \frac{(5 \cdot 2^x \ln 2)(4 \cos(x)) + (5 \cdot 2^x)(-4 \sin(x))}{(4 \cos(x))^2}$$

C
$$f'(x) = \frac{(5 \cdot 2^x \ln 2)(4 \cos(x)) - (5 \cdot 2^x)(-4 \sin(x))}{(4 \cos(x))^2}$$

D
$$f'(x) = \frac{(5 \cdot 2^x)(-4 \sin(x)) - (5 \cdot 2^x \ln 2)(4 \cos(x))}{(4 \cos(x))^2}$$

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- 30** Find the derivative $f'(x)$ using the quotient, natural exponential, and general exponential rules.

$$f(x) = \frac{4e^x}{8^x}$$

A
$$f'(x) = \frac{(4e^x)(8^x) - (4e^x)(8^x \ln 8)}{8^x}$$

B
$$f'(x) = \frac{(4e^x)(8^x) + (4e^x)(8^x \ln 8)}{(8^x)^2}$$

C
$$f'(x) = \frac{(4e^x)(8^x) - (4e^x)(8^x \ln 8)}{(8^x)^2}$$

D
$$f'(x) = \frac{(4e^x)(8^x \ln 8) - (4e^x)(8^x)}{(8^x)^2}$$

- 31** Find the derivative $f'(x)$ using the trigonometric, natural exponential, and general exponential rules.

$$\frac{d}{dx} \cos(x) = -\sin(x)$$

$$[12pt] f(x) = 3 \cos(x) + 2e^x + 5 \cdot 6^x$$

A
$$f'(x) = -3 \sin(x) + 2e^x + 5 \cdot 6^x$$

B
$$f'(x) = 3 \cos(x) + 2e^x + 5 \cdot 6^x$$

C
$$f'(x) = 3 \sin(x) + 2e^x + 5 \cdot 6^x \ln 6$$

D
$$f'(x) = -3 \sin(x) + 2e^x + 5 \cdot 6^x \ln 6$$

- 32** Find the derivative $f'(x)$ using the trigonometric, natural exponential, and general exponential rules.

$$f(x) = 4 \sin(x) + e^x + 2 \cdot 6^x$$

A
$$f'(x) = 4 \cos(x) + e^x + 2 \cdot 6^x$$

B
$$f'(x) = 4 \cos(x) + e^x + 2 \cdot 6^x \ln 6$$

C
$$f'(x) = -4 \cos(x) + e^x + 2 \cdot 6^x \ln 6$$

D
$$f'(x) = 4 \sin(x) + e^x + 2 \cdot 6^x$$