

## 3.11: Chapter 3 Review Exercises

### Chapter Review Exercises

**True or False? Justify the answer with a proof or a counterexample.**

1) Every function has a derivative.

**Answer**

False

2) A continuous function has a continuous derivative.

3) A continuous function has a derivative.

**Answer**

False

4) If a function is differentiable, it is continuous.

**In exercises 5 and 6, use the limit definition of the derivative to exactly evaluate the derivative.**

5)  $f(x) = \sqrt{x+4}$

**Answer**

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

6)  $f(x) = \frac{3}{x}$

**In exercises 7 - 15, find the derivatives of the given functions.**

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

**Answer**

$$f'(x) = 9x^2 + \frac{8}{x^3}$$

9)  $f(x) = (4 - x^2)^3$

10)  $f(x) = e^{\sin x}$

**Answer**

$$f'(x) = e^{\sin x} \cos x$$

11)  $f(x) = \ln(x+2)$

12)  $f(x) = x^2 \cos x + x \tan x$

**Answer**

$$f'(x) = x \sec^2 x + 2x \cos x + \tan x - x^2 \sin x$$

13)  $f(x) = \sqrt{3x^2 + 2}$

14)  $f(x) = \frac{x}{4} \sin^{-1}(x)$

**Answer**

$$f'(x) = \frac{1}{4} \left( \frac{x}{\sqrt{1-x^2}} + \sin^{-1} x \right)$$

15)  $x^2y = (y+2) + xy \sin x$

In exercises 16 - 18, find the indicated derivatives of various orders.

16) First derivative of  $y = x(\ln x) \cos x$

**Answer**

$$\frac{dy}{dx} = \cos x \cdot (\ln x + 1) - x(\ln x) \sin x$$

17) Third derivative of  $y = (3x+2)^2$

18) Second derivative of  $y = 4^x + x^2 \sin x$

**Answer**

$$\frac{d^2y}{dx^2} = 4^x (\ln 4)^2 + 2 \sin x + 4x \cos x - x^2 \sin x$$

In exercises 19 and 20, find the equation of the tangent line to the following equations at the specified point.

19)  $y = \cos^{-1}(x) + x$  at  $x = 0$

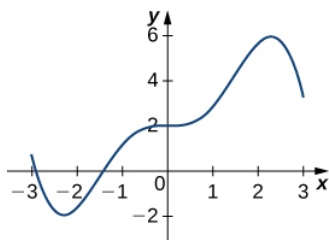
20)  $y = x + e^x - \frac{1}{x}$  at  $x = 1$

**Answer**

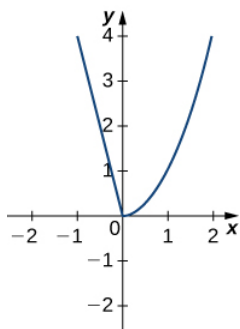
$$y = (2+e)x - 2$$

In exercises 21 and 22, draw the derivative of the functions with the given graphs.

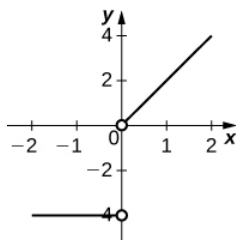
21)



22)



**Answer**



Questions 22 and 23 concern the water level in Ocean City, New Jersey, in January, which can be approximated by  $w(t) = 1.9 + 2.9 \cos(\frac{\pi}{6}t)$ , where  $t$  is measured in hours after midnight, and the height is measured in feet.

22) Find and graph the derivative. What is the physical meaning?

23) Find  $w'(3)$ . What is the physical meaning of this value?

**Answer**

$w'(3) = -\frac{2.9\pi}{6}$ . At 3 a.m. the tide is decreasing at a rate of 1.514 ft/hr.

Questions 24 and 25 consider the wind speeds of Hurricane Katrina, which affected New Orleans, Louisiana, in August 2005. The data are displayed in a table.

Hours after Midnight, August 26	Wind Speed (mph)
1	45
5	75
11	100
29	115
49	145
58	175
73	155
81	125
85	95
107	35

Wind Speeds of Hurricane Katrina Source: [news.nationalgeographic.com/n...\\_timeline.html](https://news.nationalgeographic.com/n..._timeline.html).

24) Using the table, estimate the derivative of the wind speed at hour 39. What is the physical meaning?

25) Estimate the derivative of the wind speed at hour 83. What is the physical meaning?

**Answer**

−7.5. The wind speed is decreasing at a rate of 7.5 mph/hr

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