Calculus

# 2.3 Estimating Derivatives

**Notes**

Write your questions and thoughts here!

## Estimating the Derivative with a CALCULATOR

1. If $f(x) = \sin\sqrt{x}$, find $f'(2)$.

2. If $f(x) = \ln\left(\frac{1}{5-x}\right)$, find $f'(1.3)$.

3. Write the equation of the line tangent to $y = \sqrt{\frac{x}{x^3+1}}$ at $x = 1$.

## Estimating the Derivative from TABLES

The function must be differentiable to estimate a derivative! This just means, the graph is **continuous** and **smooth**.

| $x$ hours | 0 | 2 | 4 | 7 | 11 |
|---|---|---|---|---|---|
| $f(x)$ miles | $-2$ | 3 | 10 | 1 | $-3$ |

Using the table, estimate $f'(3)$. Show the work that leads to your answer.

| $x$ Seconds | 10 | 50 | 80 | 120 | 150 |
|---|---|---|---|---|---|
| $w(x)$ Gallons per second | 950 | 850 | 700 | 500 | 150 |

Using the table, estimate $w'(100)$. Show the work that leads to your answer.

## 2.3 Estimating Derivatives

Calculus

**Practice**

**Estimate the derivative at the given point by using a calculator.**

1. $f(x) = x\sqrt{2-x}$; find $f'(-10)$.
2. $f(x) = \sec(5x)$; find $f'(2)$.
3. $f(x) = \ln(\sqrt{x})$; find $f'(1)$.
4. $f(x) = e^{\frac{x}{3}}$; find $f'(4)$.
5. $f(x) = \tan(\sin x)$; find $f'(-3)$.
6. $f(x) = 2^{\ln(x)}$; find $f'(2)$.
7. The model $f(t) = \frac{x}{\cos x}$ measures the height of bird in meters where $t$ is seconds. Find $f'(2)$.
8. The model $f(t) = \sin^2(t)$ measures the depth of a submarine measured in feet where $t$ is minutes. Find $f'(12.5)$.
9. The model $f(t) = \sqrt{x} - \frac{1}{x-1}$ measures the number of stocks sold where $t$ is days. Find $f'(12)$

**For each function, write the equation of the tangent line at the given value of $x$.**

10. $f(x) = \frac{\ln 2x}{4x}$ at $x = 1$.
11. $f(x) = \cos(\tan(x))$ at $x = 2$.
12. $f(x) = \frac{x^4}{\sqrt{x}}$ at $x = 3$.
13. $f(x) = x^2 \sin\left(\frac{1}{x}\right)$ at $x = 7$.

**Use the tables to estimate the value of the derivative at the given point. Indicate units of measures.**

14.

| $x$ Hours | 1 | 3 | 4 | 7 | 9 |
|---|---|---|---|---|---|
| $v(x)$ visitors | 120 | 476 | 595 | 807 | 902 |

a. $v'(8)$

b. $v'(3.5)$

15.

| $x$ cm | 11 | 23 | 26 | 32 | 45 |
|---|---|---|---|---|---|
| $T(x)$ °C | 71 | 51 | 40 | 36 | 10 |

a. $T'(17)$

b. $T'(24.5)$

16.

| $t$ years | 0 | 3 | 7 | 15 | 20 |
|---|---|---|---|---|---|
| $s(t)$ Students per year | 5 | 20 | 7 | $-2$ | $-4$ |

a. $s'(1.5)$

b. $s'(11)$

17.

| $t$ Days | 5 | 13 | 45 | 50 | 70 |
|---|---|---|---|---|---|
| $p(t)$ Pages per day | 51 | 20 | 21 | 36 | 58 |

a. $p'(47.5)$

b. $p'(9)$

18.

| $x$ seconds | 10 | 30 | 45 | 65 | 100 |
|---|---|---|---|---|---|
| $w(x)$ Gallons per second | 1005 | 790 | 786 | 434 | 209 |

a. $w'(20)$

b. $w'(82.5)$

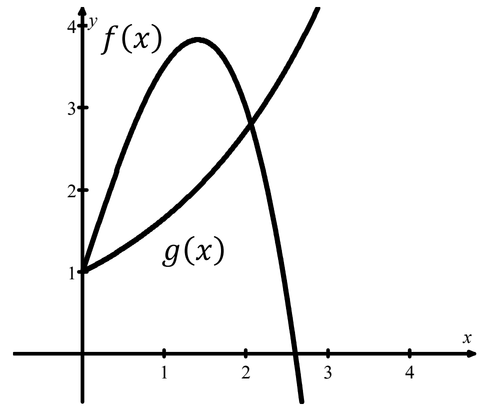
19.

| $x$ Carries | 3 | 12 | 15 | 21 | 30 |
|---|---|---|---|---|---|
| $f(x)$ yards | 15 | 107 | 98 | 150 | 272 |

a. $f'(25.5)$

b. $f'(13.5)$

20. Let $f$ and $g$ be the functions defined by $f(x) = -\frac{1}{2}x^3 + 3x + 1$ and $g(x) = e^{\frac{x}{2}}$. Let $h$ be the vertical distance between the graphs of $f$ and $g$ for $0 \leq x \leq 2$ . Find the rate at which $h$ changes with respect to $x$ when $x = 1.5$.

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21. The graph of $y = 3 - e^{5x}$ crosses the $x$-axis at one point. What is the slope of the graph at this point?

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22. Given the function $g(x) = x^3 - e^x - \sin x$, which of the following values of $x$ has a tangent line with the greatest slope?

(A) $x = -3$ (B) $x = -1$ (C) $x = 0$ (D) $x = 1$ (E) $x = 3$