

### Unit 2.3 Estimating Derivatives of a Function at a Point

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

1.  $f(x) = \sin(\cos x)$ ; find  $f'(6)$ .

$Y_1 = \sin(\cos(X))$

$$\frac{Y_1(5.9) - Y_1(6.1)}{5.9 - 6.1}$$

0.1610180548

$f'(6) \approx 0.161$

2.  $f(x) = x \ln(2 - x)$ ; find  $f'(-3)$ .

$Y_1 = X \ln(2 - X)$

$$\frac{Y_1(-3.1) - Y_1(-2.9)}{-3.1 - -2.9}$$

2.2093178916

$f'(-3) \approx 2.209$

3. The model  $f(t) = t^{50} - t^{31}$  measures the number of bacteria in a petri dish where  $t$  is measured in hours. Find  $f'(1.6)$ .

$$\frac{Y_1(1.5) - Y_1(1.7)}{1.5 - 1.7}$$

1.6617507228E12

$f'(1.6) \approx 1.662E12$  bacteria/hour

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

4.  $f(x) = x\sqrt{7-x}$  at  $x = -2$ .

Plot 1 Plot 2 Plot 3

$Y_1 = X\sqrt{7-X}$

$Y_2 = \frac{d}{dX}(Y_1)_{X=-2}$

$Y_3 =$

$Y_4 =$

$Y_5 =$

$Y_6 =$

$Y_7 =$

$Y_8 =$

$Y_9 =$

X	Y <sub>1</sub>	Y <sub>2</sub>
-2	-6	3.33333

$y + 6 = 3.333(x + 2)$

5.  $f(x) = \frac{4x}{\ln x}$  at  $x = 4.7$ .

Plot 1 Plot 2 Plot 3

$Y_1 = \frac{4X}{\ln(X)}$

$Y_2 = \frac{d}{dX}(Y_1)_{X=4.7}$

$Y_3 =$

$Y_4 =$

$Y_5 =$

$Y_6 =$

$Y_7 =$

$Y_8 =$

$Y_9 =$

X	Y <sub>1</sub>	Y <sub>2</sub>
4.7	12.14814	0.91454

$y - 12.148 = 0.915(x - 4.7)$

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

6.

$t$ hours	0	1	4	6	10
$s(t)$ skiers	0	320	2018	2305	260

a.  $s'(2.5)$

$$s'(2.5) \approx \frac{320 - 2018}{1 - 4} = \frac{-1698}{-3} = 566 \text{ skiers/hour}$$

b.  $s'(5)$

$$s'(5) \approx \frac{2018 - 2305}{4 - 6} = \frac{-287}{-2} = 143.5 \text{ skiers/hour}$$

7.

$s$ Attempts	3	8	16	20	25
$f(s)$ Made shots	1	7	10	13	15

a.  $f'(12)$

$$f'(12) \approx \frac{7 - 10}{8 - 16} = \frac{-3}{-8} = \frac{3}{8} \text{ made attempt}$$

b.  $f'(18)$

$$f'(18) \approx \frac{10 - 13}{16 - 20} = \frac{-3}{-4} = \frac{3}{4} \text{ made attempt}$$

8.

$t$ hours	1	3	9	12	18
$v(t)$ miles per hour	184	160	194	201	186

a.  $v'(15)$

$$v'(15) \approx \frac{201 - 186}{12 - 18} = \frac{15}{-6} = -\frac{5}{2} \text{ miles/hour}^2$$

b.  $v'(10.5)$

$$v'(10.5) \approx \frac{194 - 201}{9 - 12} = \frac{-7}{-3} = \frac{7}{3} \text{ miles/hour}^2$$

Answers to 2.3 CA #1

1. 0.160	2. 2.209	3. $5.022 \times 10^{11}$ bacteria per hour	4. $y + 6 = 3.333(x + 2)$	5. $y - 12.148 = 0.9145(x - 4.7)$
6. a. 566 skiers / hr b. 143.5 skiers / hr		7. a. 0.375 made shots per attempt b. 0.75 made shots per attempt		8. a. $-2.5 \text{ miles/hr}^2$ b. $2.333 \text{ miles/hr}^2$