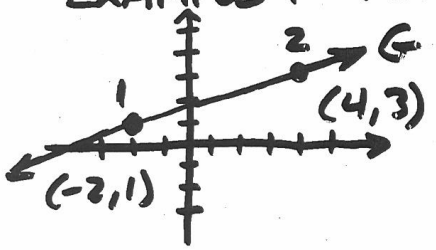
2-4 SLOPE, DERIVATIVE AND TANGENT TO A CURVE

m = SLOPE = $\frac{\text{CHANGE IN } Y}{\text{CHANGE IN } X} = \frac{\Delta Y}{\Delta X}$

$$m = \frac{Y_2 - Y_1}{X_2 - X_1} \quad \text{OR} \quad m = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

EXAMPLE 1: FIND THE SLOPE OF LINE G.



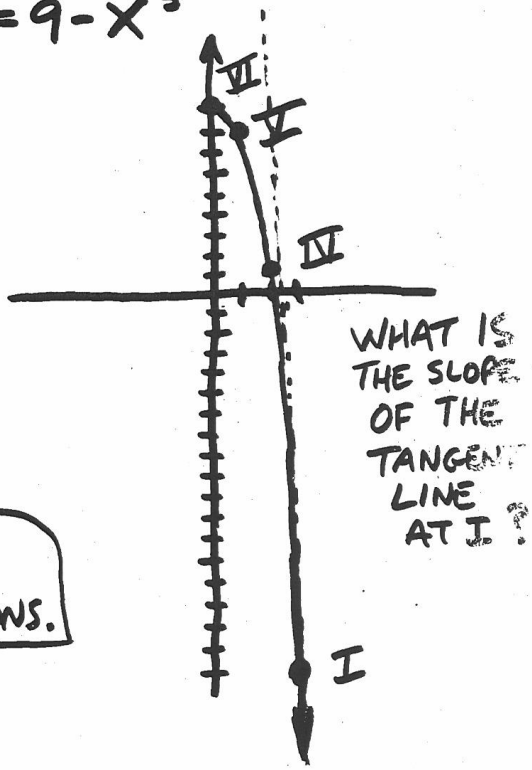
$$m = \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{3-1}{4-(-2)}$$

$$m = \frac{2}{6} \quad \text{OR} \quad m = \frac{1}{3}$$

EXAMPLE 2: $f(x) = 9 - x^3$

X	Y	
0	9	← VI
1	8	← V
2	1	← IV
2.9	-15.389	III
2.99	-17.730899	II
3	-18	← I

USE SUCCESSIVE SECANT APPROXIMATIONS.



WHAT IS THE SLOPE OF THE TANGENT LINE AT I?

(A) WHAT IS THE SLOPE OF THE SECANT LINE THAT CONNECTS POINTS VI & I? (10)

I (3, -18)
VI (0, 9)

$$m_{sec} = \frac{Y_6 - Y_1}{X_6 - X_1} = \frac{9 - -18}{0 - 3} = \frac{27}{-3} = -9$$

(B) WHAT IS THE SLOPE OF THE SECANT LINE THAT CONNECTS POINTS V & I?

I (3, -18)
V (1, 8)

$$m_{sec} = \frac{Y_5 - Y_1}{X_5 - X_1} = \frac{8 - -18}{1 - 3} = -13$$

(C) WHAT IS THE SLOPE OF THE SECANT LINE THAT CONNECTS POINTS IV & I?

I (3, -18)
IV (2, 1)

$$m_{sec} = \frac{Y_4 - Y_1}{X_4 - X_1} = \frac{1 - -18}{2 - 3} = -19$$

(D) WHAT IS THE SLOPE OF THE SECANT LINE THAT CONNECTS POINTS III & I?

I (3, -18)
III (2.9, -15.389)

$$m_{sec} = \frac{-15.389 - -18}{2.9 - 3} = -26.11$$

(E) WHAT IS THE SLOPE OF SECANT FROM II TO I?

I (3, -18)
II (2.99, -17.730899)

$$m_{sec} = \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{-17.730899 - -18}{2.99 - 3} = -26.9101$$

(F) BASED ON THIS TREND (-9 → -13 → -19 → -26.1 → -26.9) WHAT DO YOU THINK THE SLOPE OF THE TANGENT LINE IS? ANSWER: -27

AS $X \to X_1$ THE SECANT BECOMES THE TANGENT.

ASSIGNMENT: LAB 16-3 (3.1) DITTO

AVERAGE RATE OF CHANGE = SLOPE (11)

$= \frac{Y_2 - Y_1}{X_2 - X_1}$ LIKE p. 87 1-6

Ex. 1 p. 82 $f(x) = x^3 - x$ INTERVAL $[1, 3]$

X	Y
1	0
3	24

AV. RATE OF CHANGE $= \frac{Y_2 - Y_1}{X_2 - X_1} = \frac{24-0}{3-1} =$ 12

HWORK p. 87 → 1-5, 7, 8
-88