1.6 MODELING WITH LINEAR FUNCTIONS

GOALS: - WRITE EQUATIONS OF LINEAR FUNCTIONS USING POINTS AND SLOPES.

- FIND LINES OF FIT AND LINES OF BEST FIT.

CORE CONCEPTS:

GIVEN SLOPE m AND Y-INT b → SLOPE INTERCEPT FORM: $y = mx + b$

GIVEN SLOPE m AND A POINT (x_1, y_1) → POINT-SLOPE FORM: $y - y_1 = m(x - x_1)$

GIVEN 2 POINTS (x_1, y_1) (x_2, y_2)
- USE SLOPE FORMULA TO FIND m
- USE POINT-SLOPE FORM WITH EITHER POINT

SLOPE: $$m = \frac{y_2 - y_1}{x_2 - x_1}$$

EX #1: - LOOK @ THE GRAPH
- PICK 2 POINTS

$(0,0)$ AND $(\overset{x}{5}, \overset{y}{24})$

- CALCULATE SLOPE

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{24 - 0}{5 - 0} = \frac{24}{5} = 4.8$$

- NOTICE THAT THE Y-INT = 0 $\Rightarrow b = 0$

- I NOW HAVE SLOPE AND Y-INT SO USE SLOPE-INTERCEPT FORM

$$y = mx + b$$

SUBSTITUTE WHAT WE KNOW:

$$y = \frac{24}{5}x + 0$$

$$y = 4.8x$$ ← USE THIS EQ TO FIND HOW LONG IT TAKES THE ASTEROID TO TRAVEL 17,200 miles

$$17{,}200 = 4.8x$$

$$3583 = x \Rightarrow 3600 \text{ sec} = 1 \text{ hr} \Rightarrow \approx \boxed{1 \text{ hr}}$$

POINT-SLOPE:

$$y - y_1 = m(x - x_1)$$

$$y - 24 = 4.8(x - 5)$$

$$y - 24 = 4.8x - 24$$

$$+24 \qquad +24$$

$$y = 4.8x$$

EX2: - WRITE AN EQUATION FOR LAKESIDE Inn

- PICK 2 POINTS FROM THE TABLE

(100, 1500)
(125, 1800)
x y

- CALCULATE SLOPE $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1800 - 1500}{125 - 100}$

$= \frac{300}{25} = 12$

SLOPE INT:

$y = mx + b$

$1500 = 12(100) + b$

$1500 = 1200 + b$

$300 = b$

$\Rightarrow y = 12x + 300$

- NOW USE POINT SLOPE FORM

$(y - y_1) = m(x - x_1)$

$(y - 1500) = 12(x - 100)$

$y - 1500 = 12x - 1200$

$y = 12x - 1200 + 1500$

$y = 12x + 300$ ← EQ FOR LAKESIDE

WHICH CHARGES LESS PER STUDENT?

LAKESIDE = 12 PER STUDENT. ⇒ SUNVIEW CHARGES LESS / STUDENT

SUNVIEW = 10 PER STUDENT

HOW MANY STUDENTS MUST ATTEND FOR THE TOTAL COSTS TO BE THE SAME?

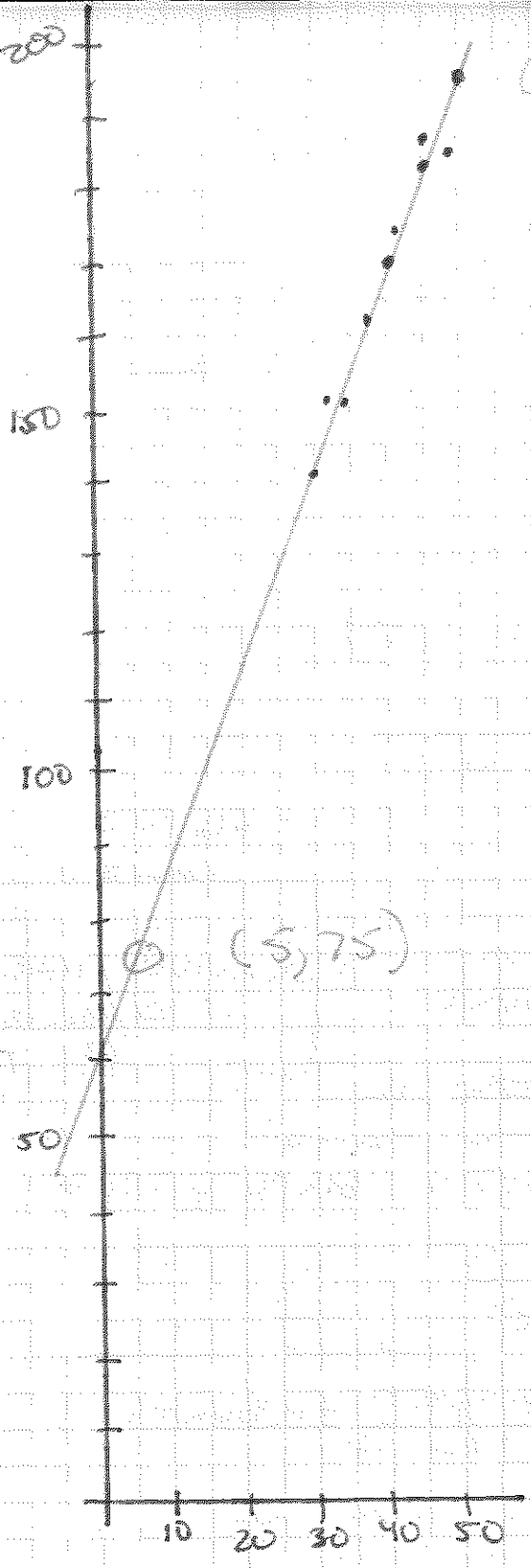
SET THEM EQUAL TO EACH OTHER SINCE y = COST.

$10x + 600 = 12x + 300$

$600 = 2x + 300$

$300 = 2x$

$150 = x$ ⇒ 150 STUDENTS



I HAVE 2 POINTS

$(50, 195)$
$(5, 75)$

FIND SLOPE:

$$m = \frac{\Delta y}{\Delta x} : \frac{\text{RISE}}{\text{RUN}}$$

$$= \frac{195 - 75}{50 - 5}$$

$$= \frac{120}{45} = \frac{24}{9} = 2.67$$

USE POINT SLOPE:

$$(y - 75) = 2.67(x - 5)$$

$$y = 2.67x - 13.35 + 75$$

$$y = 2.67x + 61.65$$

CORRELATION COEFFICIENT:

DENOTED BY r, A NUMBER FROM -1 TO 1. MEASURES HOW WELL A LINE FITS A SET OF DATA PAIRS.

WHEN r IS NEAR 1
THE POINTS LIE CLOSE TO A LINE W/ A POSITIVE SLOPE

WHEN r IS NEAR -1
THE POINTS LIE CLOSE TO A LINE W/ A NEGATIVE SLOPE

WHEN r IS CLOSE TO 0
THE POINTS DO NOT LIE CLOSE TO ANY LINE.