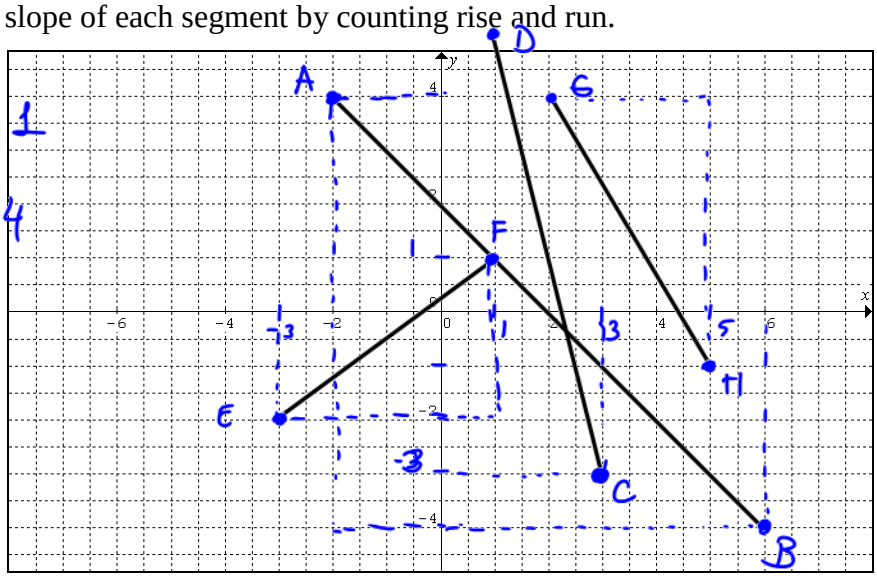
Discovering the Slope Formula

1. Plot the following points and draw the segment created by joining the points.
   (a) A(-2, 4) B(6, -4) (b) C(3, -3) D(1, 5)
   (c) E(-3, -2) F(1, 1) (d) G(2, 4) H(5, -1)

2. Determine the slope of each segment by counting rise and run.



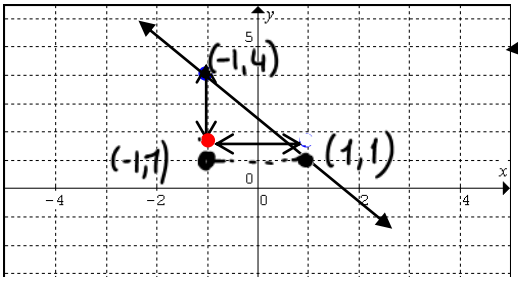
slope $\overline{AB} = \frac{-8}{8} = -1$

slope $\overline{CD} = \frac{8}{2} = 4$

slope $\overline{EF} = \frac{3}{4}$

slope $\overline{GH} = \frac{-5}{3}$

We don't want to plot points EVERY time we want to know slope. We can create a formula that uses two points to calculate the slope.



The points given here are: (-1, 4) and (1, 1).
Pretend there is a point where the two arrows meet.
This point is (-1, 1).
How can you use these 3 points to find the vertical distance (rise) and the horizontal distance (run)?

vertical $4-1=3$
horizontal $1-(-1)=2$

3. Try to create a formula that you can use to calculate the slope of each of the segments you drew above!

$$\text{slope } (m) = \frac{y_2 - y_1}{x_2 - x_1}$$

Practice with the Slope Formula #1

Find the slope of a line passing through each of the following pairs of points. State the answer in simplest form.

1. (-9, 8) and (0, 9) x_1, y_1, x_2, y_2 $m = \frac{9-8}{0-(-9)} = \frac{1}{9}$	2. (0, 6) and (5, -2) x_1, y_1, x_2, y_2 $m = \frac{-2-6}{5-0} = \frac{-8}{5}$

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Day 3: Finding Slope Using Formula **Unit 5: Linear Relations**

x_1 y_1 x_2 y_2

3. (6, 0) and (0, -6)

$m = \frac{-6-0}{0-6} = \frac{-6}{-6} = 1$ slope = 1

4. (-4, 1) and (-8, -3)

$m = \frac{-3-1}{-8-(-4)} = \frac{-4}{-8+4} = \frac{-4}{-4} = 1$ slope = 1

5. (-9, 3) and (-8, -3)

$m = \frac{-3-3}{-8-(-9)} = \frac{-6}{-8+9} = \frac{-6}{1}$ slope = 6

6. (-4, 4) and (2, -3)

$m = \frac{-3-4}{2-(-4)} = \frac{-7}{2+4} = -7/6$ slope = $-7/6$

7. (5, -4) and (6, 9)

$m = \frac{9-(-4)}{6-5} = \frac{9+4}{1} = 13/1$ slope = 13

8. (-8, -5) and (0, 3)

$m = \frac{3-(-5)}{0-(-8)} = \frac{3+5}{0+8} = \frac{8}{8} = 1$ slope = 1

9. (-1, -9) and (-6, -2)

$m = \frac{-2-(-9)}{-6-(-1)} = \frac{-2+9}{-6+1} = \frac{7}{-5} = -7/5$

10. (-3, 1) and (-1, -6)

$m = \frac{-6-(1)}{-1-(-3)} = \frac{-7}{-1+3} = \frac{-7}{2}$

11. (11, 17) and (-8, -18)

$m = \frac{-18-(17)}{-8-11} = \frac{-35}{-19} = 35/19$

12. (-14, 18) and (8, 0)

$m = \frac{0-18}{8-(-14)} = \frac{-18}{8+14} = \frac{-18}{22} = -9/11$

13. (14, -19) and (-2, -13)

$m = \frac{-13-(-19)}{-2-14} = \frac{-13+19}{-16} = \frac{6}{-16} = -3/8$

14. (-2, 14) and (-9, -17)

$m = \frac{-17-14}{-9-(-2)} = \frac{-31}{-9+2} = \frac{-31}{-7} = 31/7$

15. (-16, 5) and (-5, -5)

$m = \frac{-5-5}{-5-(-16)} = \frac{-10}{-5+16} = \frac{-10}{11}$

16. (-17, 7) and (9, -4)

$m = \frac{-4-7}{9-(-17)} = \frac{-11}{9+17} = -11/26$

17. (-49, -86) and (25, 93)

$m = \frac{93-(-86)}{25-(-49)} = \frac{93+86}{25+49} = \frac{179}{74}$

18. (-91, -20) and (-43, 3)

$m = \frac{3-(-20)}{-43-(-91)} = \frac{3+20}{-43+91} = \frac{23}{48}$

Practice with the Slope Formula #2

1. Calculate the slope of the line given the following two points:
   a) (5, 2) and (-1, 8) (b) (–8, 1) and (-9, 2)
   c) (3, 7) and (-5, -9) (d) (-4, 0) and (4, 6)
   e) (0, 0) and (-2, 10) (f) (-6, 24) and (4, 4)
   g) (8, -7) and (-6, -7) (h) (-2, 1) and (-1, 3)

a) $m = \frac{8-2}{-1-5} = \frac{6}{-6} = -1$

b) $m = \frac{2-1}{-9+8} = \frac{1}{-1} = -1$

c) $m = \frac{-9-7}{-5-3} = \frac{-16}{-8} = 2$

d) $m = \frac{6-0}{4+4} = \frac{6}{8} = 3/4$

e) $m = \frac{10-0}{-2-0} = \frac{-10}{-2} = 5$

f) $m = \frac{4-24}{4+6} = \frac{-20}{10} = -2$

g) $m = \frac{-7+7}{-6+8} = 0$

h) $m = \frac{3-1}{-1+2} = \frac{2}{2} = 1$

a) The following graph shows the cost of renting a banquet hall. Initially the cost is $300 just for the hall. There is a per person cost in addition to the initial fee to cover the meal cost.

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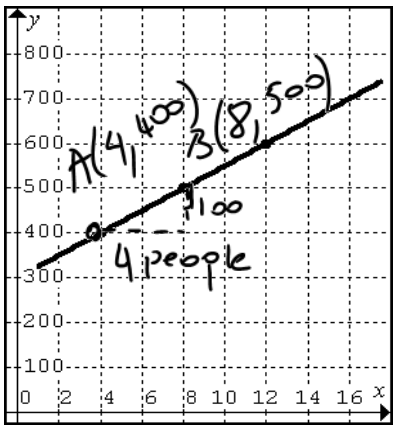


How much does it cost for each additional person who attends the event? This value is called the **rate of change**, and is a unit rate – in this case cost per person.

Unit Rate = $\frac{100}{4}$ = $25/person

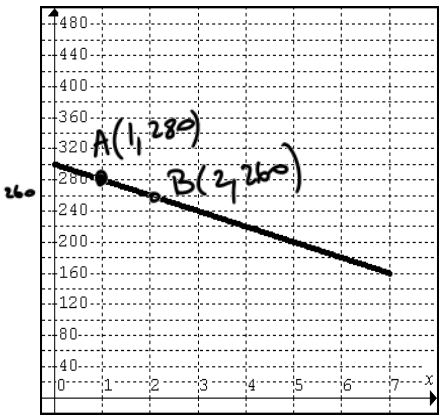
Calculate the slope of this line.

slope $\overline{AB} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{500-400}{8-4} = \frac{100}{4} = 25$

b) The following graph shows the balance in Jenny's bank account over 7 weeks. She started with $300 in her account but has been spending her money at a constant rate.

How much did her account decrease by each week? This value is called the rate of change, and in this case is spending per week.

$20



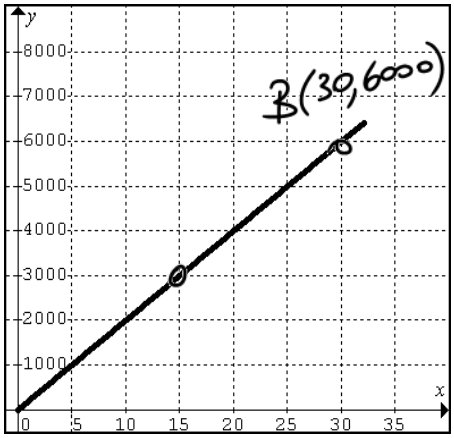
Calculate the slope of this line.

slope $\overline{AB} = \frac{260-280}{2-1} = \frac{-20}{1} = -20$

c) Molly is an antique hunter. Her father had found a unique gem years ago on the ground (it was free!!). Over time this item became more and more rare. The value for this item increased at a constant rate over the years and now, 30 years later, it is worth $6000. Each year the value increased by around $600. Calculate the slope of the line.

How much did this gem increase in value each year? This value is called the rate of change, and in this case is $ value per year.

Rate of change $600



Calculate the slope of this line.

$m\overline{AB} = \frac{6000-0}{30-0} = \frac{6000}{30} = 500$