Total Recall (Warm-up) (5 minutes approx.)

Total Recall: Exercise from yesterday's lesson on linear equations rate of change.

In this exercise, a used car is purchased for $7000.00. You find out from your parents or your auto mechanic friend that the average monthly cost to operate a vehicle (fuel, insurance, maintenance, license fees) is $200.00 per month. Write an equation (linear in slope-intercept form) to describe the total monthly cost of owning a car after 1 month? After 6 months? After 1 year?

(A: y = 200x + 7000) What is the slope? (200) What is the y-intercept? (7000)

Direct Instruction (10 minutes approx.)

Most of the time data collected and plotted is not perfectly linear. In a previous lesson we compared the salaries of a construction worker to a mechanical engineer. Today, we have salaries of an administrative assistant (AA) and a registered nurse (RN); at 1 year, 5 years and 10 years. The data shown is taken from two different sources and reported in two different ways. One is in hourly pay, the other in yearly pay.

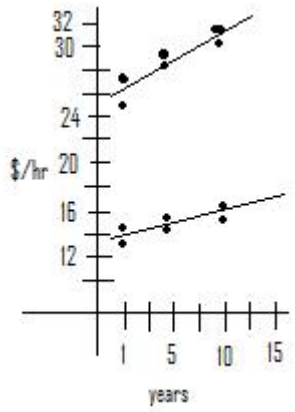
Report A (hourly)

Years	**AA**	**RN**
1	$13.30	$24.86
5	$14.50	$28.76
10	$15.61	$30.48

Report B (yearly)

Years	**AA**	**RN**
1	$30k ($14.40)	$57k ($27.40)
5	$33k ($15.80)	$62k ($29.80)
10	$35k ($16.0)	$65k ($31.25)

Using this data, predict what the salary will be at the 15 year worked? We can do this by plotting the data and drawing a "best fit" line and extend it out. First, we will need to convert one set of data to match the other. Lets convert the yearly to hourly by dividing the yearly salary by the number of weeks in a year, 52, and then by the number of working hours in a week, 40. The results are shown above in the yearly table in parenthesis. The data is plotted over in the adjacent cell.



Scatter plot with "best fit" lines to extend data for predicting future salary.

Practice (5 minutes approx.)

U-DO: Plot the following data to see if there is correlation to draw a "best fit" line. The following data is some estimates from two sources of the salary a single person needed to make in order to afford a one bedroom apartment. The apartment rental is based on being a maximum of 1/3 of the salary. Is there enough information to predict the salary needed in 2010 to afford an apartment?

<table>
<tr>
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<table>
<tr><th>Year</th><th>Source A</th><th>Source B</th></tr>
<tr><td>2004</td><td>$19.8k</td><td>$20.2k</td></tr>
<tr><td>2005</td><td>$20k</td><td>$20.5k</td></tr>
<tr><td>2006</td><td>$21.7</td><td>$22k</td></tr>
<tr><td>2007</td><td>$23.3k</td><td>$24k</td></tr>
<tr><td>2008</td><td>$27.7</td><td>$28.5k</td></tr>
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These numbers are rough estimates. You can check with your local realtor or apartment rental listings to get actual data, for specific areas.
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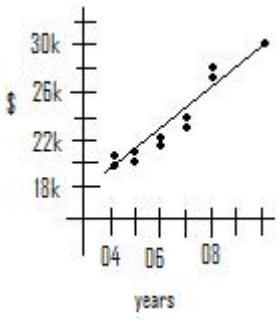

Projected out to 2010, it appears that $30k salary will be needed by a single person to afford an apartment.
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<td>Direct Instruction and Practice (10 minutes approx.)</td>
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Using best fit line for projections off the graph: In the above exercise, the projection of 2010 was as far as the graph went. For a projection to 2014, take 2 points from the best fit line, find the slope and create an equation. Here is how:

Looking closely at the best fit line it appears that for 2005 the salary is $21k and in 2006 the salary is $23k. Slope = $(y_2-y_1)/(x_2-x_1)$ = (23k – 21k)/(2006-2005) = 2k/1. There is a point slope format equation that we can use now that we know the slope and have a point. The point slope format is: $y - y_1 = m(x - x_1)$

Using the point slope format, slope of 2k, and the point (2005, 21k):

$y - 21k = 2k(x - 2005)$

$y - 21{,}000 = 2000x - 2000(2005)$

$y = 2000x - 2000(2005) + 21{,}000 = 2000x - 3989000$

Because we used 2005 for the year, we have the y axis at year 0, and the y intercept is -4031000, which is unrealistic. How can we make this easier to work with? (A: By setting the y axis at year 2000, so that 2000 = 0)

Now we have $y = 2000x - 2000(5) + 21000 = 2000x + 11000$ or:

$y = 2000x + 11{,}000$ Substitute 14 (2014) for x and y = 39,000 or 39k
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<td>Practice: (5 minutes approx.)</td>
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U-DO: Find the projected salaries needed for a single person to rent and apartment in 2016, 2020? (A: 43k; 51k)

**Note: Projections are subject to market and economic fluctuations. Talk about how these projections are basically educated guesses, based on historical data. The projection cannot be guaranteed, because there may be some extreme economic change that could shift the ‘best fit’ line.
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<td>Direct Instruction: (15 minutes approx.)</td>
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The following data is theoretical, based on some research, so it may or may not be realistic. These are the starting salaries for two career choices: Administrative Assistant (AA) and Mechanical Engineer (ME). Plot the data, draw a best fit line for each and predict the salaries in 2010, 2014 and 2016.

Answer: The plot for Administrative Assistant is shown. Notice that it passes through two of the points plotted: (04, $19.5k) and (08, $28k). Using these two
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<table>
<tr><td></td><td>points and the point slope form:
Slope = $(y_2-y_1)/(x_2-x_1)$ = (28k – 19.5k)/(8 – 4) = 2125
Equation using (08, 28k): y – 28,000 = 2125(x – 8) y = 2125x + 11,000
For 2010 the salary is 32250; 2014 = 40750; 2016 = 45000</td></tr>
<tr><td></td><td>
<table>
<tr><th>Year</th><th>AA</th><th>ME</th></tr>
<tr><td>2004</td><td>$19.5k</td><td>$40k</td></tr>
<tr><td>2005</td><td>$22.5k</td><td>$42k</td></tr>
<tr><td>2006</td><td>$23k</td><td>$45k</td></tr>
<tr><td>2007</td><td>$25k</td><td>$49k</td></tr>
<tr><td>2008</td><td>$28k</td><td>$54k</td></tr>
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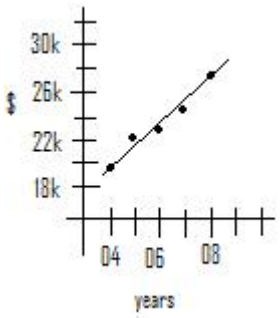

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<tr><td>Wrap-up
(5 minutes approx.)</td><td>Wrap up closing comments and housekeeping.
Discuss how you can compare data by looking at slope. It is interesting to know if the Administrative Assistant salary will keep ahead of the rental salary. For that to happen, the slope of the salary has to be greater than the rental.
The more data you have, the better the prediction you can make. You can usually go back in time and find historical data to see if it fits your ‘best fit’ line.</td></tr>
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