MATH 161 — Precalculus[1]
Community College of Philadelphia

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Math 161 — Chapter 1
Class Exercises

In this set of exercises you follow the price of the stock of the company as listed in the newspaper listings of the New York Stock Exchange for a period of time, and answer some questions about it. Your instructor will supply you with the name of the stock, the time period covered and the source of information.

1. From the newspaper listings create a **table** including entries for each trading date and the price of a share of your stock at the close of trading. (This information is in the next-to-the-last column in most listings.) Also, for the first day, record the change from the day before (given in the last column).

2. Create a graph of your data with *time* as the variable along the horizontal axis and the *price per share* along the vertical axis. Your graph should include:

   (a) a title,

   (b) labeled axes,

   (c) labeled units on the axes, and

   (d) your plotted data.

3. How much would 100 shares of your stock have cost at the close of trading on on the first day of your record?

4. If you purchased 100 shares of your stock at the close of trading on the first day of your record and sold them at the close of trading on the sixth day, how much profit would you have made?

5. Imagine that you had purchased 100 shares of your stock at the close of trading on some day and held it for **exactly** 2 consecutive days.

   (a) On which day should you have purchased the stock to make the most profit?

   (b) Describe how you can recognize this day by examining your graph.

6. Imagine that you had purchased 100 shares of your stock at the close of trading on some day and held it for **exactly** 2 consecutive days.

   (a) Which purchase day would have resulted in the greatest loss?

   (b) Describe how you can recognize this day by examining your graph.

7. What was the average price of a share of your stock at closing over the first five trading days of your record?

8. For the second through sixth trading day, find the change in the closing price from the day before. We call this change the *rate of change* of the price of the stock (in dollars per day).

9. Use your numbers from the last problem to calculate the average daily rate of change of the price in *dollars per day* for the second through the sixth trading days.

10. Find the total change in the price of the stock over the from closing on the first day to closing on the sixth day.

11. Divide the total change found in the previous question by five. What is the relationship between this answer and the number you got for the average daily rate of change in the stock's price? Would this relationship always hold, for any number of trading days and any set of closing prices? Give an example of a case when it would not or explain why it always would.

Motion Sensor Exercises. You will be able to experiment with a motion sensor connected to a computer or a graphing calculator. The motion sensor detects your position at a set of closely spaced time intervals, and displays the data points as a graph on the screen. You should play with equipment and get a feel for what's going on and then complete the following exercises.

12. Make sure that your motion sensor is working, and then complete the following exercises.

    (a) Have someone in your group walk near the motion sensor in a planned way. Your plan might be something like: "Stand still for 2 seconds, then walk slowly away for 2 seconds, and then walk back towards the sensor for 2 seconds at the original speed. Does the graph make sense?

    (b) Repeat this exercise with different plans for everyone in your group.

    (c) Your instructor will give you a transparency to tape on your computer screen showing the graph of a walker's position *vs.* time. Start the computer program and walk in such a way that your position *vs.* time graph that is drawn on the computer screen matches as closely as possible the graph on the transparency.

13. Juan the walker takes a stroll westward (toward the higher-numbered streets) on Walnut Street, starting at 43rd Street at noon, walking at a steady rate, reaching the corner of 53rd Street at 1 o'clock.

    (a) Where is he at 12:15?

    (b) Where is he at 12:30?

    (c) Where is he at 12:45?

    (d) Where is he at 12:51?

    (e) Draw a graph of Juan's position as a function of time. Plot position (in blocks) along the vertical axis and time (in minutes since noon) on the horizontal axis.

14. Michael the meanderer starts at 43rd and Walnut at noon, walking westward (toward higher-numbered streets). He walks at a steady rate

of 30 blocks an hour (*i.e.*, one block every two minutes) for twenty minutes, then stops to talk to a friend for fifteen minutes. He remembers something he left at 43rd St., so he turns around and walks back to 43rd Street at the same speed that he was originally walking.

(a) Where is he at 12:10?

(b) Where is he at 12:15?

(c) Where is he at 12:20?

(d) Where is he at 12:25?

(e) Where is he at 12:30?

(f) Where is he at 12:35?

(g) Where is he at 12:40?

(h) Where is he at 12:45?

(i) When does he get back to 43rd and Walnut?

(j) Draw a graph of Michael's position as a function of time. Plot position (in blocks) along the vertical axis and time (in minutes since noon) on the horizontal axis. (If you have completed exercise 13 use the same piece of graph paper as you used for that exercise.)

15. Sally the Stroller also starts at 43rd and Walnut at noon, but she walks towards the east (toward lower-numbered streets). She walks at a steady rate of 30 blocks an hour (*i.e.*, one block every two minutes) for twenty minutes, then stops to talk to a friend for fifteen minutes. She remembers something she left at 43rd Street, so she turns around and walks back to 43rd Street at the same speed that she was originally walking.

(a) Where is she at 12:10?

(b) Where is she at 12:15?

(c) Where is she at 12:20?

(d) Where is she at 12:25?

(e) Where is she at 12:30?

(f) Where is she at 12:35?

(g) Where is she at 12:40?

(h) Where is she at 12:45?

(i) When does she get back to 43rd and Walnut?

(j) Draw a graph of Sally's position as a function of time. Plot position (in blocks) along the vertical axis and time (in minutes since noon) on the horizontal axis. (If you have completed exercise 13 use the same piece of graph paper as you used for that exercise.)

16. At noon Joelle starts at 63rd and Walnut and walks eastward (toward lower-numbered streets) at a steady rate of 15 blocks an hour and Pierre starts at 33rd and Walnut and jogs westward at 25 blocks an hour.

(a) Where is Joelle at 12:10? Where is Pierre at this time?

(b) Where is Joelle at 12:15? Where is Pierre at this time?

(c) Where is Joelle at 12:20? Where is Pierre at this time?

(d) Where is Joelle at 12:30? Where is Pierre at this time?

(e) Where is Joelle at 12:45? Where is Pierre at this time?

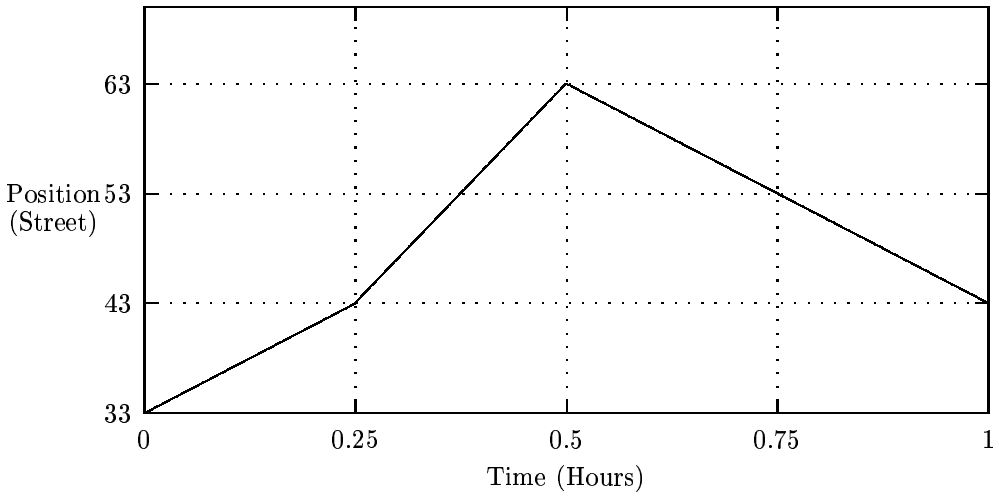
(f) On a single sheet of graph paper draw a graph of Joelle's position as a function of time and Pierre's position as a function of time. Plot position (in blocks) along the vertical axis and time (in minute since noon) on the horizontal axis.

(g) When do Pierre and Joelle meet?

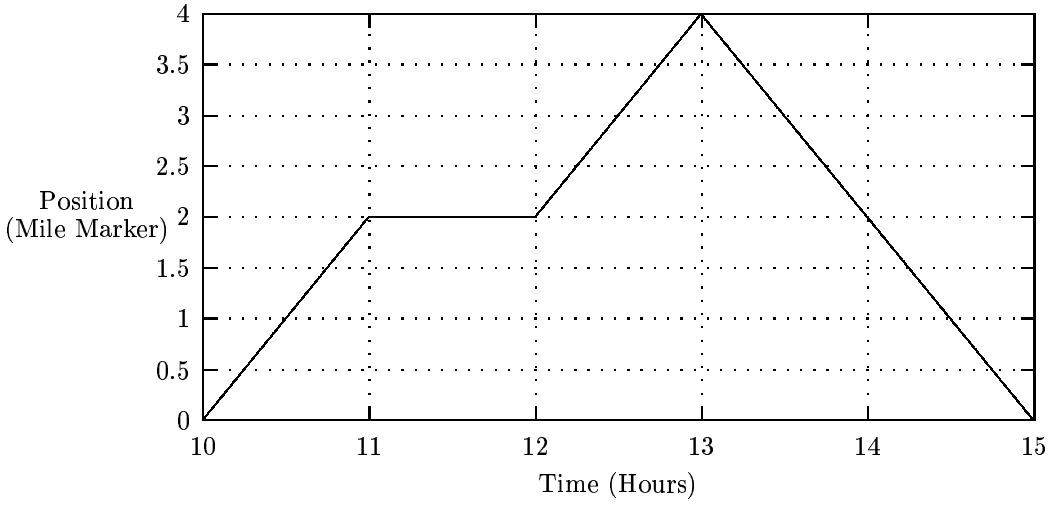
(h) Where do Pierre and Joelle meet?

17. Assume each of the following graphs is the *position versus time* graph for walker. Give a specific and complete description of the person's motion. Your description should include enough information about the walker's position, speed, and direction of travel during various time intervals so that someone else can reconstruct the graph from your description.

Problem 17a



Problem 17b



18. A set of points represented by ordered pairs of the form (x, y) may all share the same mathematical relationship between the y values and the x values. For example, they may be related by the equation $y = 3x - 2$.

    (a) Make a table like the one in the text for points (x, y) such that $y = 3x - 2$, with rows for the following values of x: -3, -1.5, -1, 0, 1, 2.5 (that is, compute the y for each of these numbers) and with rows for the following values of y: 7, -2, 5 (that is, compute the x for each of these numbers)

    (b) Plot the set of points (x, y) such that $y = 3x - 2$ on a full sheet of graph paper with appropriately labeled axes.

19. The graph below illustrates four lines, labeled **A**, **B**, **C**, and **D**. Make and fill in a table with a row for each line and a column for:

    (a) the slope of the line.

    (b) the y-intercept.

    (c) the x-intercept.

    (d) the equation of the line.

20. Juan goes to the park, where there are mile markers along the walking path. He starts at mile marker 5, setting his stop watch to zero as he starts. He strides along at the rate of 4 miles per hour for three hours, moving towards higher-numbered markers.

    (a) Where is he at time 1 hour?

    (b) Where is he at time 1.5 hours?

    (c) Where is he at time 2 hours?

    (d) How far does he travel in three hours?

    (e) Figure out a formula that gives his position (call this p) as a function of time (call this t).

21. Each of the equations below gives a straight line. (Assume that y is the variable plotted on the vertical axis, and x is the variable plotted on the horizontal axis.) Make and fill in a table with a row for each equation and a column for:

    (a) the slope of the line.

    (b) the y-intercept of the line.

    (c) the x-intercept of the line.

    Equation A: $y = 3x + 7$

    Equation B: $y = 2x - 4$

    Equation C: $y = -x + 3$

    Equation D: $2y = x - 6$

    Equation E: $y + 3x - \pi = 0$

    Equation F: $4(x - 2y) = 3$

    Equation G: $y = 3 - \sqrt{2}x$

    Equation H: $\frac{3x-2y}{4} = 6y$

    Equation I: $7\left(4x + 3(y + 5)\right) = 2x$

22. Find the equation of the following lines:

    (a) The line through $(17, -3)$ and $(18, -8)$.

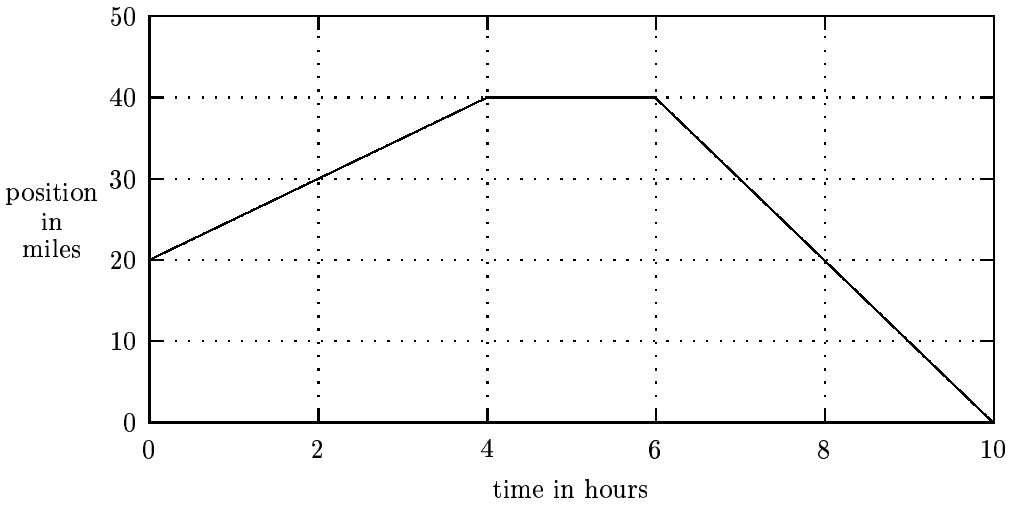
    (b) The line with y-intercept 7 and x-intercept -14.

    (c) The horizontal line through the point $(3 - 4)$.

    (d) The vertical line through the point $(1, 6)$.

23. The graph below shows Juan's progress along a trail marked in miles. Noon is indicated as time "0" on the horizontal axis.

Problem 23



(a) Where is he at 2 o'clock?

(b) Where is he at 4?

(c) Where is he at 6?

(d) At 8 pm, how far is he from where he was at 2 pm?

(e) The graph above of Juan's progress is made up of three connected line segments.

i. Figure out a formula that gives his position, p, as a function of time t for any time between noon and 4 o'clock.

ii. Figure out a formula that gives his position, p, as a function of time t for any time between 4 and 6 o'clock.

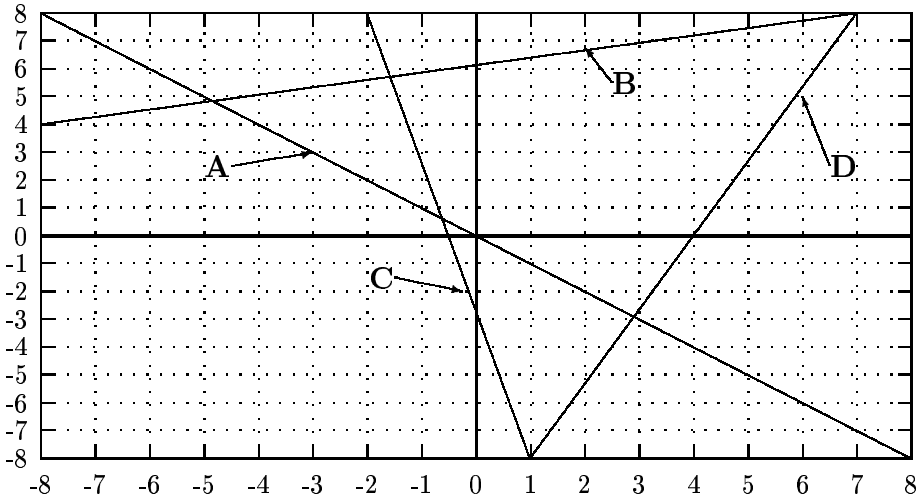
iii. Figure out a formula that gives his position, p, as a function of time t for any time between 6 and 10 o'clock.

24. Do the points $(1, 6)$, $(3, 10)$, and $(11, 23)$ lie on a line? Explain your reasoning and justify your answer.

25. Do the points $(a, 6a)$, $(2a, 12a)$, and $(-1.5a, -9a)$ lie on a line? (The variable a can have any value, but it has the same value in all of the expressions.) Explain your reasoning and justify your answer.

26. Find the slope of each line segment shown on the following graph, and list them in order of least to largest. (Remember, least means farthest to the left on the number line.)

Line Segments for Problem 26



27. For each of the following descriptions of a line, decide whether there exists a line answering the description. If there is, give its equation in the form $y = mx + b$ and sketch its graph. If not, explain why not. If there is more than one such line, say so and give the equation of one of them.

    (a) passes through the points $(1, 4)$, $(2, 7)$, and $(3, 10)$

    (b) passes through the points $(1, 0)$, $(82, 0)$, and $(-15, 0)$

    (c) passes through the points $(0, 69)$, $(0, 0.987)$, and $(0, -8971)$

    (d) passes through the points $(1, 6)$, $(3, 10)$, and $(11, 23)$

    (e) passes through the points $(-3, 5)$, $(0, 0)$, and $(6, 9)$

    (f) passes through the points $(3, 4)$, $(6, 9)$, and has slope 2

    (g) passes through $(0, 0)$ and has slope 5

    (h) is perpendicular to the x-axis and parallel to the y-axis

(i) is parallel to the x-axis and to the line $y = 9$

(j) passes through the point $(4, 2)$ and is parallel to the line with the equation $y = 2x + 3$

(k) passes through the point $(-1, -3)$ and is perpendicular to the line with the equation $x - 2y = 5$

(l) is perpendicular to the lines $y = 6x$ and $y = -2x$, and passes through their intersection

(m) has the same x- and y-intercepts as the line $y = 8x - 16$, and is perpendicular to it

(n) passes through the intersection of $2x + y = 9$ and $3x - y = 11$

(o) passes through the intersection of $2x + y = 9$ and $3x - y = 11$ and the intersection of $x - y = 8$ and $x + y = 2$.

(p) passes through the points $(a, 0)$ and $(a + 3, 6)$

(q) passes through the point (k, p) and has slope r

(r) passes through the point (c, d) and has slope d/c

28. The questions below refer to a five-day forecast from a local newspaper.

Day	High/Low Temperature
Today	82°
Tonight	70°
Friday	86°/70°
Saturday	84°/68°
Sunday	84°/66°
Monday	80°/60°

(a) What is the highest low for the 5 days for which the forecast is given?

(b) What is the lowest high for the 5 days?

(c) On what day will the temperature high increase the most from the day before (assuming the forecast is accurate)?

(d) On what day will the temperature high decrease the most from the day before?

(e) Graph the predicted temperature high against time.