Handout 1

Important Topics

- Math Review
- Opportunity Costs, Comparative Advantage and Absolute Advantage (if time permits)

Math Review

We'll use a lot of algebra and graphs in this course. It's important that the rote math steps are automatic so we can focus on the more interesting economic applications. So, you should be comfortable graphing equations, finding an equation from a graph, solving for two unknowns with two equations, and calculating percentages.

1. Graphing a line is usually most conveniently done if we first have the equation in *slope intercept* form.

   Slope intercept form: $y = mx + b$

   - m is the slope, rise over run.
   - b is the y-intercept, i.e. the point where the line given by the equation crosses the y-axis.

   Sometimes you instead encounter the same equation, but in the form $x = a + cy$. We have x in terms of y instead of in the usual slope intercept form. Here, it turns out a is the x-intercept and c is the inverse slope.

   Alternatively, you can simply transform the equation to slope-intercept form: $x = a + cy \leftrightarrow cy = x - a \leftrightarrow y = \frac{1}{c}x - \frac{a}{c}$. Identify the slope-intercept form and verify that the slope of the line is $\frac{1}{c}$ and the y-intercept is $-\frac{a}{c}$.

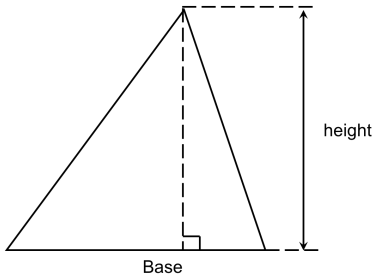
   To draw a line, it is sufficient to know two points on that line. Thus, if you are given a linear equation (i.e. an equation depicting a line), you can choose any two values of x-coordinates and substitute them for x in the equation to get corresponding y-coordinates, or vice versa, thereby obtaining two sets of coordinates on the line. If a given linear equation is in slope-intercept form, we can directly get a set of coordinates $(0, c)$ since the y-intercept (denoted by c) is known. In this case, we only need to find one other set of coordinates to draw the line.

   Conversely, we can find the equation of a graphed line by reading off two points on that line. We can denote the two points as (x_1, y_1) and (x_2, y_2). We can obtain the slope of the line as the ratio $m = \frac{y_2 - y_1}{x_2 - x_1}$. To get the equation of the line, we can then substitute coordinates in the equation: $y - y_1 = m(x - x_1)$.

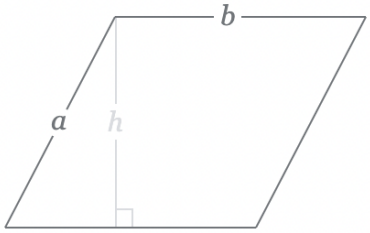
2. **Percentage change:** If we have an original and a new value, the percentage change is calculated as

$$\frac{New\ Value - Old\ Value}{Old\ Value} \times 100.$$

3. **Triangle area:** $= \frac{1}{2} \times base \times height$



4. **Parallelogram area:** $= base(b) \times height(h)$



Special cases:

- A rectangle is a parallelogram with all internal angles equal to 90^o. Same formula for area. $Area = b \times h$.
- A square is a rectangle with all sides equal. Same formula, but can be simplified. In this case, since $b = h$, we can use $Area = b^2$ or $= h^2$.

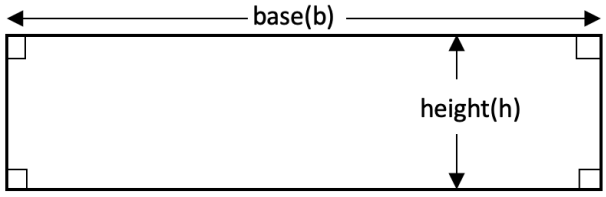


Figure 1: A rectangle

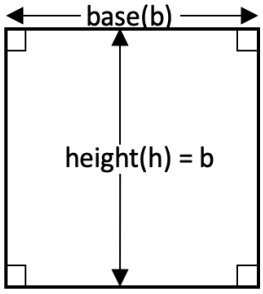
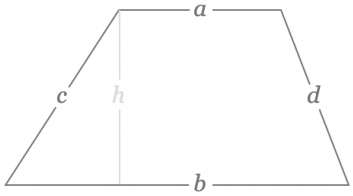
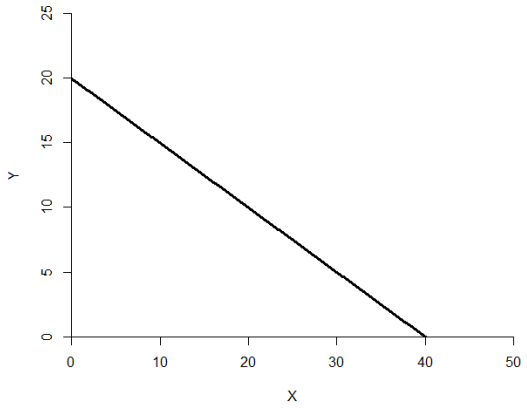


Figure 2: A square

5. (*Optional*) **Trapezium area:** $= \frac{1}{2} \times (a + b) \times h$



Exercise 1: Find the equation for the graph below. What is the area below the curve (the triangle formed with the axes)?



Exercise 2: Solve for x and y given the equations
$y = 2x + 4y + 2$
$x = 2y + 4$.

Exercise 3: Graph $x = 10y$ and $y = 100 - x$. What is the area of the triangle enclosed by the two lines and the y-axis?

Exercise 4: In 2013, Theranos, the health technology company, was valued at \$9 billion. More recently, the company's value has been revised to \$800 million. What is the percentage change in the company value?

Exercise 5: On June 14, 2000, the Indiana Pacers lost to the Los Angeles Lakers in game four of the NBA finals, giving the Lakers a 3-1 edge on the series. Shaquille O'Neal made 10 free throws on 17 attempts. Reggie Miller made 11 free throws on 12 attempts. How many more free throws would Shaq have to make in a row to match Reggie's percentage?

Economics

Opportunity Cost: the best alternative that we give up, or forgo, when we make a choice or decision.

Comparative Advantage: the advantage that one (an individual or country) can produce a good or service at a lower opportunity cost than the other (individuals or countries)

Absolute Advantage: the advantage that one (an individual or country) can produce more of a good or service than the others (individuals or countries)

Exercise 6: A Robinson Crusoe Economy

Crusoe finds himself stranded on an island. He devotes 10 hours each day to either gathering coconuts or catching fish. Crusoe can gather 2 coconuts in an hour, but he needs 5 hours to catch a single fish. On the other side of the island is Friday. Friday also devotes 10 hours each day to gathering coconuts and fishing. He can gather 3 coconuts per hour and needs only 2.5 hours to catch a fish.

a.) What is the opportunity cost of gathering a coconut for Crusoe? For Friday? Who has the comparative advantage in gathering coconuts? Who has the absolute advantage?

b.) What is the opportunity cost of catching a fish for Crusoe? For Friday? Who has the comparative advantage in catching fish? Who has the absolute advantage?

Multiple Choice Questions

Exercise 7:

Suppose that the only input in the production of wheat and soy is labor. In 2017, Country A uses the same amount of labor in the production of wheat as it does in the production of soy, resulting in the production of 8,000 tons of wheat and 10,000 tons of soy. Suppose that in 2018, country A produces an additional 500 tons of wheat despite no increase in the total amount of labor available in the country. Assuming constant opportunity costs and holding everything else constant, how many tons of soy were produced in 2018?

a. 9375

b. 9600

c. 9750

d. 9900

Exercise 8:

Two firms, A and B, produce smartphones and tablets. In 4 days, firm A can produce 32 smartphones or 48 tablets. Firm B can produce 12 smartphones or X tablets in one day. For what value of X will firm B have the comparative advantage in producing tablets?

a. $X > 8$

b. $X < 8$

c. $X > 18$

d. $X < 18$