Exercises for Math 102

University of British Columbia
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1. Review of Straight Lines

Exercise 1. The graph of Fahrenheit temperature, °F, as a function of Celsius temperature, °C, is a line. You know that 212 °F and 100 °C both represent the temperature at which water boils. Similarly, 32 °F and 0 °C both represent water's freezing point.

(a) What is the slope of the graph?

(b) What is the equation of the line?

(c) Use the equation to find what Fahrenheit temperature corresponds to 20 °C.

(d) What temperature is the same number of degrees in both Celsius and Fahrenheit?

Exercise 2. Find the equation of the straight line that passes through (1,1) and is perpendicular to the line $y = -2x + 4$. What are the coordinates of the intersection point?

Exercise 3. A patient has a problem of high fever. At the initial time the doctor checked, it was 37°C. Now, after an hour, it is 42°C. If the doctor does not give any treatment, what will be the fever after 10 more minutes? Estimate the value.

Exercise 4. Determine whether the three points $A = (-1, -3)$, $B = (2, 4)$, and $C = (5, 10)$ are collinear, that is, whether there is a *single* line passing all of the three points. Justify your answer.

Exercise 5. Consider a straight line through the points $A = (1, 4)$ and $B = (4, 3)$. Find the coordinates of the intersection with

(a) the x-axis.

(b) the y-axis.

(c) a line through the origin with slope 2.

Exercise 6. Given a line defined by the equation $y = mx + b$ with $m \neq 0$.

(a) Exchanging x and y in the given equation $y = mx + b$ leads to another equation

$$x = my + b.$$

This is an equation of a line $y = nx + c$. Express n and c in terms of m and b.

(b) With $m = 2$ and $b = 3$, draw the three lines $y = mx + b$, $y = x$, and $y = nx + c$ on the same x-y plane. Here, you find the values of n and c by using the formulas obtained in (a). Observe that you have two lines "symmetric" about the line $y = x$.

Exercise 7. This exercise is concerned with the multi-step problem in Section 1.4.1 (see Fig. 1.3).

(a) *Without* using the known equation satisfied by the line passing through A and B, find the area of the triangle with vertices 0, T, and A. (*Hint*: Draw an auxiliary line from T down to the x-axis and another from T to 0. Call C the intersection point of the x-axis and the auxiliary line from T down to the x-axis. Note that the two triangles $\triangle 0TC$ and $\triangle TCA$ are similar and you already know the side lengths of the triangle $\triangle 0TC$.)

(b) Find the area of $\triangle BT0$ by a similar reasoning.

(c) Find the area of $\triangle B0A$ by using your answers in (1) and (2). Compare your answer with the answer in the course note.