

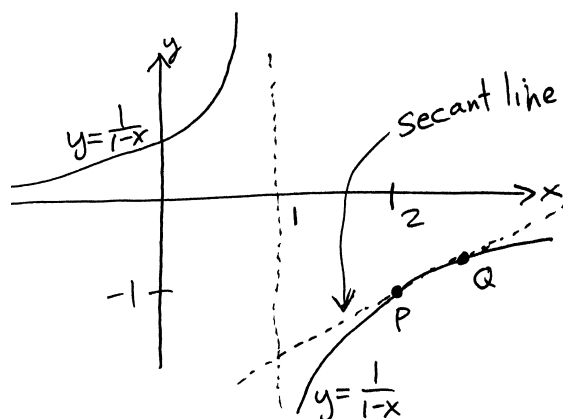
Solutions to Section 2.1 Activity (Worksheet)

1. The first part has a clear answer. The second and third parts have best answers I could find. (A more thorough search might be required?) The fourth part has a guess.

1. $m = (0.9 - 0.44)/(2017 - 1990) = +0.017$ C/year
2. the ten-year period [1992, 2002]: $m = (0.62 - 0.22)/10 = +0.04$ C/year
3. the ten-year period [1998, 2008]: $m = (0.52 - 0.62)/10 = -0.01$ C/year
4. from line through (2010, 0.7) that looks vaguely reasonable: $m = +0.0074$ C/year

Every function, even data which is really bumpy or rough, does have secant lines. It is always cheap to compute the slopes of secant lines, but for rough data such slopes don't mean much! However, calculus is mostly about better-behaved functions like in problems 2 and 3.

2. a)



- b) In this part P is the fixed point $(2, -1)$ while Q is the point given by the following x -values.

Let $f(x) = 1/(1-x)$. Then:

- (i) $m = (f(1.5) - f(2))/(1.5 - 2) = 2.0$
 - (ii) $m = (f(1.9) - f(2))/(1.9 - 2) = 1.11$
 - (iii) $m = (f(1.99) - f(2))/(1.99 - 2) = 1.01$
 - (iv) $m = (f(1.999) - f(2))/(1.999 - 2) = 1.001$
 - (v) $m = (f(2.5) - f(2))/(2.5 - 2) = 0.6667$
 - (vi) $m = (f(2.1) - f(2))/(2.1 - 2) = 0.9091$
 - (vii) $m = (f(2.01) - f(2))/(2.01 - 2) = 0.9901$
 - (viii) $m = (f(2.001) - f(2))/(2.001 - 2) = 0.9990$
- c) Based on the above I would guess that the tangent line slope at $P(2, -1)$ is $m = 1$.
- d) We have a point and a slope so the equation of line is immediate:

$$y - (-1) = 1(x - 2) \quad \text{or} \quad y = x - 3$$

3. If you plot the data with a computer you see it is all close to one line. Here we first compute the four secant line slopes:

- a) $m = 68.8$ beats/min
- b) $m = 71.8$ beats/min
- c) $m = 72.5$ beats/min
- d) $m = 71.0$ beats/min

We can say with some confidence that the heart monitor should report a number between 69 and 72. My choice for best estimate averages the secant slopes from a) and b):

$$m = \frac{1}{2}(68.8 + 71.8) = 70.3 \text{ beats/min}$$