

MAT – 112: Calculus I and Modeling

EFY 2

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Instructions

Please complete each of the following problems. You should work in groups of three, or at most four, and hand in only one submission per group. Be sure that your arguments are well justified and presented clearly.

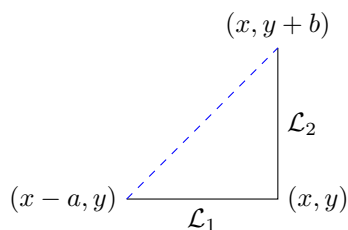
Problem 1. In 1683, Jacob Bernoulli considered the following questions regarding compound interest:

An account starts with \$1.00 and pays 100 percent interest per year. If the interest is credited once, at the end of the year, the value of the account at year-end will be \$2.00. What happens if the interest is computed and credited more frequently during the year?

Make a table of values for m and A , where m is the number of times interest is compounded during the year and A is the value of the account at year-end. Let m range from 1 to 100 counting by 10. Do you recognize the value that A appears to be approaching? Try larger values of m and see if you can guess.

Problem 2. Two lines \mathcal{L}_1 and \mathcal{L}_2 are perpendicular, provided that \mathcal{L}_1 is horizontal and \mathcal{L}_2 is vertical, or the slope of \mathcal{L}_1 is $m \neq 0$ and the slope of \mathcal{L}_2 is $-\frac{1}{m}$.

Consider the first case, which is drawn below. The angle at the intersection



of \mathcal{L}_1 and \mathcal{L}_2 is at 90 degrees if and only if the triangle formed is a right triangle. Show that the triangle is indeed a right triangle by showing that Pythagorean's theorem holds.

Hint: The length of the hypotenuse (blue dashed line) is equal to the distance between the points $(x-a, y)$ and $(x, y+b)$. In general, the distance between two points (x_1, y_1) and (x_2, y_2) is equal to

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$