

Be sure to follow all the directions for written homework as listed in the document Writing Requirements on our Canvas Homepage. Also follow the general outline of the Template T1: Rates of Change and the Sample Homework Solution, both available on our Homepage. Use only the ideas of Section 2.1 to solve these problems.

Thoroughly explain your responses to the following questions in the form of two letters to a friend who does not have any knowledge of calculus. Be sure to incorporate the parts of the question in the flow of your letter.

Be sure to include the following elements in your solution.

- Define the relevant variables to the appropriate function.
- Find an expression for the function, including the appropriate domain. Graph the function.
- Give numerical evidence to support or refute the claim that small changes in the input gives approximately proportional changes in the output. Be sure to define these changes explicitly and to include units in your computation.
- End each part of the question with a concluding sentence.

Letter to a Friend (10 points). *At 9:00am a stock sells at a price of \$35/share. Give evidence to support or refute the claim that the change in the number of shares you can buy with \$3,500 is approximately proportional to a small change in the price.*

In giving this evidence, be sure to do the following:

- i) First, find a function that expresses the exact change in the number of shares in terms of the change in price.*
- ii) Use part i) to compute enough difference quotients that suggest or refute a **progression** toward a limit.*
- iii) Include units in all steps of your computations.*

Then if the claim appears to be true, do the following:

- i) Compute the proportionality constant to three significant figures.*

ii) State your final approximation of the proportionality constant. Include units.

iii) Show and explain how the proportionality constant is related to the graph of the function.

iv) Write the relationship that expresses the approximate change in the number of shares in terms of the small change in price.

Letter to a Friend (10 points). A tree trunk is inclined at a 60° to the ground. The top end of a ladder rests against the trunk at a distance of 2 feet from its base. The bottom end rests on the ground (assumed to be horizontal) at a distance of 11 feet from the trunk's base. The trunk leans directly toward the ladder, so that the trunk, ground, and ladder form a triangle with a 60° angle.

Give evidence to support or refute the claim that the change in distance between the top of the ladder and the base of the tree is approximately proportional to a small change in the distance between the bottom end and the trunk's base.

In giving this evidence, be sure to do the following:

i) First, find a function that expresses the exact change in distance between the top end of the ladder and the trunk's base in terms of the distance between the bottom end and the base.

ii) Use part i) to compute enough difference quotients that suggest or refute a **progression** toward a limit.

iii) Include units in all steps of your computations.

Then if the claim appears to be true, do the following:

i) Compute the proportionality constant to three significant figures.

ii) State your final approximation of the proportionality constant. Include units.

iii) Show and explain how the proportionality constant is related to the graph of the function.

iv) Write the relationship that expresses the approximate change in the distance between the top end of the ladder and the trunk's base in terms of the distance between the bottom end and the base.