

MATH 1310-1 — Midterm 3 Fall 2022

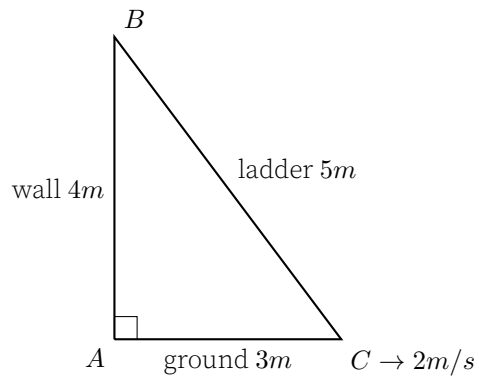
Name: _____ Unid: _____

Date: 11/18/2022

Instructor: William Nesse

No phones, calculators, or notes. Show all your work for full credit.

1. Consider a 5-meter-length ladder BC leaning against the wall of a house, forming a right triangle with the ground (see Figure). Suppose the foot of the ladder at C loses traction and slides horizontally at $2m/s$ when the ladder's foot C is $3m$ from the wall. How fast is the top of the ladder B sliding down the wall?

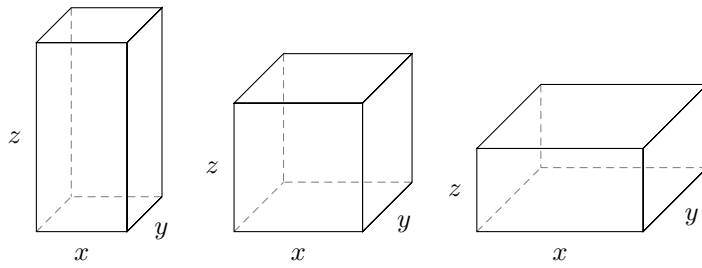


2. Identify the indeterminate forms and evaluate the following limits using l'Hospital's rule (LHR). Be sure to verify the hypotheses permitting LHR before it is used, and be sure to write all "lim" symbols at each juncture.

(a) $\lim_{x \rightarrow 0} \frac{\sin(x)}{x}$

(b) $\lim_{x \rightarrow \infty} x e^{-\sqrt{x}}$

3. Consider a box constructed out of $4m^2$ of cardboard with dimensions x, y, z . The box has an open top—**it only has 5 sides**. The base of the box is a perfect square $x = y$. Find the dimensions x, y, z that maximizes the volume of the box given the limited $4m^2$ amount available. Are the optimal dimensions $z > x$, $z = x$, or $z < x$?



4. Consider the function $f(x) = \cos(x)$ on the interval $[-\pi/2, \pi/2]$. Setup an approximate Riemann sum with $n = 10$ points, uniformly spaced, using the left-endpoint rule, to estimate the area under the curve on the interval $[-\pi/2, \pi/2]$: that is determine $\sum_{i=1}^n (?)\Delta x$.
- (a) Specify x_i^* and $i = ?, \dots, ?$
 - (b) Specify $\Delta x = ?$.
 - (c) Compose all details of the approximate Riemann sum $\sum_{i=1}^n (?)\Delta x$.

Extra space—please indicate on the main page(s) if you utilize this space for your answers.