Welcome back to MAT137- Section L5101

- Assignment #4 due today! .
- Test 2 opens on Dec 4
- Assignment #5 due on Dec 20.
- **Next class: Optimization**
  - **Watch videos 6.3, 6.4**

Let's get started!!

Today's videos: 6.1,6.2
Today's topic: Related rates

Any question from previous class?

Intervals of monotonicity

Let $g(x) = x^3(x^2 - 4)^{1/3}$.

Find out on which intervals this function is increasing or decreasing.
Using that information, sketch its graph.

To save time, here is the first derivative:

$$g'(x) = \frac{x^2(11x^2 - 36)}{3(x^2 - 4)^{2/3}}$$

Inequalities

Prove that, for every $x \in \mathbb{R}$

$$e^x \geq 1 + x$$

Hint: Where is the function $f(x) = e^x - 1 - x$ increasing or decreasing? What is its minimum?

Lake ripple

We drop a pebble into a lake. It produces a circular ripple. When the radius is 2 meters and is increasing at a rate of $10cm/s$, at what rate is the area increasing?

Sliding ladder

A ten-meter long ladder is leaning against a vertical wall and sliding. The top end of the ladder is 8 meters high and sliding down at a rate of 1 meter per second. At which rate is the bottom end sliding?

Math party

The MAT137 TAs wanted to rent a disco ball for their upcoming party. However, since they are poor, they could only afford a flashlight. At the party, one TA is designated the "human disco ball". The TA stands in the center of the room pointing the flashlight horizontally and spins at 3 revolutions per second. (Yes, they are that fast, believe me!)

The room is square with side length 8 meters. At which speed is the light from the flashlight moving across the wall when it is 3 meters away from a corner?

Coffee

A coffee filter is shaped like an inverted cone. It has a radius at the top of $4cm$ and it is $6cm$ in height. Coffee flows out of at the bottom at a rate of $2cm^3/s$. If the filter begins completely filled, how fast is the coffee level decreasing after 30 seconds?