

# MVT & Optimization

While working in a group make sure you:

- Expect to make mistakes but be sure to reflect/learn from them!
  - Are civil and are aware of your impact on others.
  - Assume and engage with the strongest argument while assuming best intent.
1. Assume  $f$  is differentiable. If  $f(1) = 3$  and  $2 \leq f'(x)$  for  $1 \leq x \leq 5$ , how small can  $f(5)$  possibly be?
  2. Production of an item has fixed costs of \$10,000 and each item costs \$2 to produce. Assume the relationship between price and quantity demanded is *linear*. Market research shows that 10,100 items are sold when the price is \$5 and 12,872 items are sold when the price is \$4.50. Find how many items the company should produce to maximize profit.

3. A photographer is taking a picture of a 4-foot painting hung in an art gallery. The camera lens (positioned on a tripod) is 1 foot below the lower edge of the painting. How far should the camera be from the painting to maximize the angle subtended by the camera lens?

4. An offshore oil well is located in the ocean at a point W, which is 5 miles from the closest shorepoint A on a straight shoreline. The oil is to be piped to a shorepoint B that is 8 miles from A by piping it on a straight line under water from W to some shorepoint P between A and B and then on to B via a pipe along the shoreline. If the cost of laying pipe is \$100,000 per mile under water and \$75,000 per mile over land, where should the point P be located to minimize the cost of laying the pipe?

