1. Find the critical points, intervals of increase and decrease, inflection points and intervals of concavity for the following functions:
   a. \( f(x) = -3x^2 - 12x \)
   b. \( f(x) = 5x^3 e^x \)
   c. \( f(x) = 3 - \frac{4}{x} - \frac{2}{x^2} \)
   d. \( f(x) = x^2 \ln x \)
   e. \( f(x) = \frac{2x - 4}{x + 2} \)

2. Find all critical points and the intervals of increase and decrease given the following:
   a. \( f'(x) = -5x^2(x - 4)(x + 2) \)
   b. \( f'(x) = \frac{x^2 - 9}{3(x^2 - 4)^{3/2}} \)

3. Find the absolute maxima and the absolute minima for the following:
   a. \( f(x) = x^4 - 18x^2 + 32 \) on \([-4, 4]\)
   b. \( f(x) = \frac{1}{3}x^3 + 2x^2 - 21x + 7 \) on \([0, 6]\)

4. You would like to make an open rectangular box with square base from 48 m\(^2\) of material. Find the dimensions of the box that will result in the largest possible volume.

5. A container in the shape of a right circular cylinder with no top has surface area 3 \( \pi \) m\(^2\). Find the height \( h \) and base radius \( r \) that will maximize the volume of the cylinder?

6. There are 50 apple trees in an orchard. Each tree produces 800 apples. For each additional tree planted in the orchard, the output per tree drops by 10 apples. How many trees should be added to the existing orchard in order to maximize the total output of trees?

7. A cylindrical can is to hold 20 \( \pi \) m\(^3\). The material for the top and bottom costs $10/m.\(^2\) and material for the side costs $8/m.\(^2\). Find the radius \( r \) and height \( h \) of the most economical can.

8. Find the linearization \( L(x) \) for the function \( f(x) = \ln(4x) \) at \( x = \frac{1}{4} \)

9. Use linear approximation to estimate the value of \( (16.01)^{3/4} \)

Note: With many thanks to Kendra Kilmer