- 7. [8 points] Mx. Miserable's Maids (or, MMM) charges
  - an \$18 "drive up" fee per house cleaning;
  - \$40 per 1000 square feet for the first 2500 square feet;
  - then \$32 per 1000 square feet beyond 2500.

For example, the cost to clean a 750 square foot house is \$18 + \$30 = \$48. Additionally, they will not take on any clients with houses greater than 5000 square feet.

**a**. [2 points] How much does MMM charge for cleaning a 3000 square foot house? Show all work. Given your answer rounded to at least two decimal places.

Solution: They will charge

- \$18 for the drive up fee;
  - $$40 \times 2.5 = $100$  for the first 2500 square feet;
- and  $32 \times 0.5 = 16$  for the remaining 500 square feet.

In total, that is \$18 + \$100 + \$16 = \$134

<u>134</u> dollars

**b.** [6 points] Let C(a) be the price, in dollars, that MMM charges for a single visit to a house that is *a* **thousand square feet**. Find a piecewise-defined formula for C(a):

Solution: For the first 2500 square feet, the rate is \$40 / 1000 sq. feet, plus a fixed cost of \$18. So the initial formula is 18 + 40a, where a is the number of square feet in thousands. Since this rate is good up to 2500 square feet, this formula holds up to a = 2.5. There are several ways of approaching the solution to the second part of the formula. One thing we know is that the slope is 32, because we're told that the rate is \$32 / 1000 sq. feet, once we're above 2500 sq. feet. But we need to add some constant to this. We could set up slope-intercept form (y = ma + b) and use a point to solve for b. However, point-slope form is quite a bit easier. In this case, when a = 2.5, the overall cost C(2.5) should be  $18 + 2.5 \times 40 = 118$ . This means our two pieces of our graph meet at the point (2.5, 118). So we can use this point in our point-slope form and get C(a) = 32(a-2.5) + 118. This rate will hold for areas between 2500 square feet and 5000 square feet, so for  $2.5 \le a \le 5$ .

$$C(a) = \begin{cases} \frac{18 + 40a}{32(a - 2.5) + 118}, & \frac{0 \le a \le 2.5}{2.5 \le a \le 5} \end{cases}$$