

4. [9 points] Let  $h(w)$  be a function, with values given in the following table:

$w$	1	2	4
$h(w)$	8	10	14

- a. [2 points] Briefly explain why  $h(w)$  could be a linear function of  $w$ , and find a linear formula for  $h(w)$ . For the rest of the problem, assume that  $h(w)$  is linear.
- b. [3 points] Let  $q(w)$  be a quadratic function of  $w$ , where  $q(w)$  has its vertex at  $(1, 8)$  and passes through the  $w$ -intercept of  $h(w)$ . Find a formula for  $q(w)$ .
- c. [1 point] Is the graph of  $q(w)$  concave up or concave down?
- d. [3 points] Find the zeroes of  $q(w)$ .
5. [13 points] You're buying baking supplies (flour, butter, apples, etc.) for your pie business. Let  $A(d)$  be the amount of money (in dollars) you'll get back from selling the pies you make from  $d$  dollars of supplies. For each dollar you spend on supplies between 0 and 50 dollars, you'll get back \$2. For each additional dollar over the first 50 dollars you invest you get back \$3.

- a. [4 points] From the description above, write down a piecewise formula for the function  $A(d)$ . Use standard piecewise notation:

$$A(d) = \left\{ \begin{array}{l} \\ \\ \\ \end{array} \right.$$

- b. [4 points] Evaluate  $A^{-1}(190)$  and give a practical interpretation of your answer.
- c. [5 points] Find a piecewise formula for the composition  $A(A(d))$ . Use standard piecewise notation.
6. [13 points] You're looking at buying two cars:
- Car A is worth \$30,000 initially, and the value decreases by 15% annually.
  - Car B is worth \$20,000 initially, and the value also decreases exponentially. Let  $r$  be the annual growth rate. Note that  $r$  is negative.
- a. [3 points] If we know that the values of Car A and Car B will be equal at some point in the future, which of the following must be true? Briefly explain your reasoning.
- i.  $r < -0.15$ .
  - ii.  $r > -0.15$ .
  - iii. We do not have enough information to decide.
- b. [3 points] Suppose that  $r$  is some value so that the cars do eventually become the same price, and then  $r$  increases (so  $r$  gets closer to 0) and everything else stays the same. Will the time it takes for the two cars to become equal in value increase or decrease? Briefly explain your reasoning.
- c. [4 points] Let  $t$  be the number of years from now when the two cars are equal in value. Find  $t$  (in exact form). Your answer may contain  $r$ .
- d. [3 points] If the cars will be equal in value in 10 years, find  $r$  (in exact form).