

Exercise set 5.2: Quadratic models

1. What is the equation of the parabola that passes through the points (1,2), (4,-4) and (-1,-14)?

$$y = ax^2 + bx + c$$

$$2 = a \cdot 1^2 + b \cdot 1 + c \Rightarrow 2 = a + b + c \Rightarrow c = 2 - a - b \quad \textcircled{1}$$

$$-4 = a \cdot 4^2 + b \cdot 4 + c \Rightarrow -4 = 16a + 4b + c \quad \textcircled{2}$$

$$-14 = a(-1)^2 + b(-1) + c \Rightarrow -14 = a - b + c \Rightarrow -14 = a - b + (2 - a - b)$$

$$-14 = \cancel{a} - b + 2 - \cancel{a} - b$$

$$-16 = -2b$$

$$b = 8 \quad \textcircled{3}$$

$$\text{Sub } \textcircled{1} \text{ into } \textcircled{2}: -4 = 16a + 4b + 2 - a - b$$

$$-4 = 15a + 3b + 2$$

$$-6 = 15a + 3b$$

$$\text{Now sub } \textcircled{3}: -6 = 15a + 3 \cdot 8$$

$$-6 = 15a + 24$$

$$-30 = 15a$$

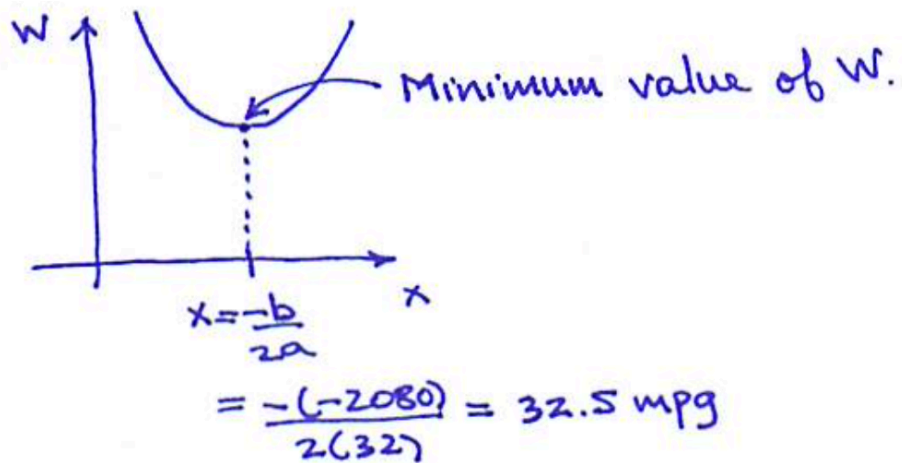
$$a = -2 \quad \textcircled{4}$$

$$\text{Now sub } \textcircled{4} \text{ \& } \textcircled{3} \text{ into } \textcircled{1} \text{ to find } c: c = 2 - (-2) - 8$$

$$c = -4$$

$$\therefore \text{Equation is } y = -2x^2 + 8x - 4$$

2. The amount of carbon dioxide (in pounds per 15,000 miles) released by a typical SUV depends on its fuel efficiency according to the formula $W = 32x^2 - 2,080x + 44,000$ where x is the fuel efficiency of an SUV in miles per gallon. According to the model what fuel efficiency produces the least carbon dioxide emissions?



3. What are the equations of the functions below? (Hint: They are all transformations of $y = x^2$)

