Homework Check: FCM 12 p. 293 # 2 – 4, 6, 10, 11 (do not copy graph – use colors), 12, 13

Note: Quadratic Models

A quadratic model can be represented in a number of ways: a parabola on a graph, in an equation of the form \( y = Ax^2 + Bx + C \) or \( y = A(x - r)(x - s) \) or \( y = A(x - g)^2 + h \), or in a table of values where the second differences are constant. Finding a quadratic regression makes use of one of the types provided depending on the information provided. If you are given x intercepts and one other point, use \( y = A(x - r)(x - s) \) or if you are given a vertex and one other point, use \( y = A(x - g)^2 + h \). For example, find the quadratic regression of the following curves.

*from the given graph, we must decide which method we will use based on the information provided.
*this graph provides a choice that many do no because we have both the vertex AND the x intercepts
*we will use this graph to look at how either method works

METHOD 1: Using X Intercepts

Step 1 – identify your x intercepts and replace \( r \) and \( s \) with these values

\[
y = A(x - r)(x - s)
\]

\[
y = a(x - (-1))(x - 7)
\]

\[
y = a(x + 1)(x - 7)
\]

Step 2 – identify another point on the curve and substitute it for x and y and solve for \( a \)
\[ y = a(x + 1)(x - 7) \]
\[ 3 = a(1 + 1)(1 - 7) \]
\[ 3 = a(2)(-6) \]
\[ 3 = -12a \]
\[ \frac{3}{-12} = a \]
\[ a = -0.25 \]

**Step 3** – use your x intercepts and newly found value of a to write the equation
\[ y = -0.25(x + 1)(x - 7) \]

or if we were asked to give the standard form of the equation
\[ y = -0.25\left[x^2 - 7x + x - 7\right] \]
\[ y = -0.25\left(x^2 - 6x - 7\right) \]
\[ y = -0.25x^2 + 1.5x + 1.75 \]

**METHOD 2: Using the Vertex**

**Step 1** – identify the vertex and replace \( g \) and \( h \) in the corresponding form
\[ y = A(x - g)^2 + h \]
\[ y = a(x - 3)^2 + 4 \]

**Step 2** – identify another point on the curve and substitute it for \( x \) and \( y \) and solve for \( a \)
\[ y = a(x - 3)^2 + 4 \]
\[ 3 = a(1 - 3)^2 + 4 \]
\[ -1 = a(-2)^2 \]
\[ -1 = 4a \]
\[ \frac{-1}{4} = a \]
\[ a = -0.25 \]

**Step 3** – use your vertex and the newly found value of a to write the equation
\[ y = -0.25(x - 3)^2 + 4 \]

or if we were asked to give the standard form of the equation
\[ y = -0.25(x - 3)(x - 3) + 4 \]
\[ y = -0.25\left[x^2 - 3x - 3x + 9\right] + 4 \]
\[ y = -0.25\left(x^2 - 6x + 9\right) + 4 \]
\[ y = -0.25x^2 + 1.5x - 2.25 + 4 \]
\[ y = -0.25x^2 + 1.5x + 1.75 \]

*notice that these equations are the same*

◆ **Homework:** FCM 12 p. 303 # 1 – 6, 10, 13, 14