From Factored to Standard Form

This is the equation of a parabola, in standard form: \( y = ax^2 + bx + c \). The important points of the function are sometimes more difficult to see in this form, but they can be found using your knowledge of factored form.

0. Recall:

<table>
<thead>
<tr>
<th>Factored Form of a quadratic function looks like</th>
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<tbody>
<tr>
<td>( y = a(x - p)(x - q) )</td>
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</table>

In terms of \( a, p, \) and \( q \),

The x-intercepts (the roots) are:

The y-intercept is:

The x-coordinate of the vertex is:

1. Given the function \( y = 2x^2 - 2x - 24 \),
   a. Find the roots (by factoring).
   b. Find the y-intercept.
   c. Find the coordinates of the vertex.
   d. Find the sum and product of the roots. (You will see why this is useful later.)

2. Take the equation \( y = a(x - p)(x - q) \), and distribute, so as to write it in standard form. [Hint: this is a two-step process. First multiply \( a(x - p) \). Then multiply the product by \( (x - q) \).]

3. Write formulas for \( b \) and \( c \) in terms of \( a, p, \) and \( q \).

4. Generalize for any quadratic in standard form:

<table>
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<td>( y = ax^2 + bx + c )</td>
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</table>

In terms of \( a, b, \) and \( c \),

The y-intercept is:

The sum of the roots is:

The product of the roots is:

The x-coordinate of the vertex is:
Using Factored and Standard Form

For the quadratic equations listed below, find:

a. the y-intercept
b. the roots (by factoring)
c. the sum and product of the roots (with your formulas)
d. the x-coordinate of the vertex (how is it related to the sum of the roots?)
e. the y-coordinate of the vertex
f. use a-e to graph the parabola accurately, on graph paper
g. check your answers, using your graphing calculator

1. \( y = x^2 - x - 6 \)
2. \( y = 5x^2 - 35x + 60 \)
3. \( y = -3x^2 - 18x - 24 \)
4. \( y = 2x^2 - 4x - 6 \)
5. \( y = -x^2 + 2x \)
6. \( y = 4x^2 - 1 \)

Discussion

7. Do all parabolas have a y-intercept?
8. Do all parabolas have x-intercepts?
9. Do all parabolas have a vertex?
10. Does the formula for the x-coordinate of the vertex work when there are no x-intercepts?