4 Using Technology Wisely Worksheet

Concepts:

- Advantages and Disadvantages of Graphing Calculators
- How Do Calculators Sketch Graphs?
- When Do Calculators Produce Incorrect Graphs?
- The Greatest Integer Function
- Graphing Calculator Skills
  - Locating the Graph (TRACE AND TABLE)
  - Changing the Viewing Window (WINDOW)
  - Connected Mode vs. Dot Mode
  - The ZOOM Features
  - Finding Approximate Coordinates for Intersection Points
  - Finding Approximate Coordinates for x-intercepts
- The Intersection Method Revisited
- The Intercept Method Revisited

(Sections 2.1-2.2)

1. Sketch a complete graph of each equation. Make sure that you label the axes for each graph. Which graphs can you draw without the assistance of a calculator? If you used your calculator to help you sketch a graph, what feature(s) of the calculator helped you to sketch a reasonable graph?

   (a) $y = 3x + 7$

   (b) $4x^2 + 9y^2 = 36$

   (c) $y = \dfrac{2}{x^2 - 4}$

   (d) $y = 5x^7 - 20x^4 + 3x^2 - 8$

   (e) $y = 3^{x^2+5}$

   (f) $y = [\![\sqrt{x}]\!]$

   (g) $y = \dfrac{1}{\sqrt{x - 7}}$

2. Which of the following equations should be solved algebraically and which should be solved graphically? Solve each equation. If the solution you find is approximate, be sure to indicate that it is approximate with $\approx$. If you use a graph to find a solution, be sure to sketch the graph and label it.

   (a) $3x^6 = 5x^3 + 2$

   (b) $\dfrac{x}{x^5 + 1} = 2$

   (c) $\sqrt{x + 7} = x$

   (d) $x^3 + 15 = 5x^2 + 3x$

   (e) $x^3 + 15 = 5x^2 + 3$

3. Compare and contrast each pair of graphs.

   (a) $y = x^3$ and $y = (x + 4)^3$

   (b) $y = |x|$ and $y = |x - 1|$

   (c) $y = |x|$ and $y = |x|$

   (d) $y = [\![x]\!]$ and $y = [\![2x]\!]$

   (e) $y = [\![x]\!]$ and $y = 2[\![x]\!]$

   (f) $y = x^2$ and $y = |x^2|$

4. We can use algebraic properties to prove that

$$(x + 3)^2 = x^2 + 6x + 9$$

for all x values. We can see further evidence of this property by looking at the graphs of $y = (x + 3)^2$ and $y = x^2 + 6x + 9$. Graph $y = (x + 3)^2$ and $y = x^2 + 6x + 9$ in the same viewing rectangle. What do you notice?

You should note, that we needed Algebra to prove that $(x + 3)^2 = x^2 + 6x + 9$ for all x values. The graphs do not prove the identity. They only provide some encouraging evidence that the identity is true.

On the other hand, consider the graphs of $y = x^2 + 4$ and $y = (x + 2)^2$. Sketch these graphs in the same viewing rectangle. These are very different graphs. They do intersect at the point $(0, 2)$, but they are very different at all other points. In general $x^2 + 4 \neq (x + 2)^2$ unless $x = 0$.

Use your knowledge of algebra and graphs to determine which of the following equations definitely are identities, which might be identities and which definitely are not identities. Use graphical evidence to support your conclusion.

	Definitely An Identity	Might Be An Identity	Not An Identity
$(x+1)^3 = x^3 + 3x^2 + 3x + 1$			
$\|x-3\| = \|x\| + 3$			
$\|x-3\| = \|x\| - 3$			
$\sqrt{x^2} = x$			
$\sqrt{x^2+1} = x + 1$			
$\sqrt{x^2+1} = x + 1$			
$\sqrt{x^2+1} = \|x+1\|$			
$\sqrt{x^2+2x+1} = \|x+1\|$			
$\dfrac{1}{x^2} + \dfrac{1}{x} = \dfrac{1}{x^2+x}$			
$\dfrac{1}{x^2} + \dfrac{1}{x} = \dfrac{1+x}{x^2}$			

5. Show that the equation $x^2 - 2x - 6 = \sqrt{2x+7}$ has two real solutions by graphing the left and right sides in the standard window and counting the number of intersection points. Approximate the solutions. (Make sure you use $\approx$ for approximate solutions.)

6. Look for solutions of

$$\sqrt{x^4 - 5x^2 + 1} = 0$$

graphically. Solve the equation algebraically.

7. What would you enter in your calculator if you wanted the graph of $2x - 4(y+3)^4 + 1 = 0$?