Math 3201

6.3B Solving Exponential Equations with Different Bases

In all the examples and questions we looked on Lesson 6.3A, both sides of our exponential equations contained powers in which the bases were powers of each other. That is, if they didn't already have a common base, we were able to come up with one.

We will now consider exponential equations in which the powers **cannot** be written with a common base. There are two ways that these types of equations can be solved:

- Using systematic trial (we'll learn this now)
- Using logarithms (we'll do this in the next unit)

Example 1:
Use systematic trial to solve $2^x = 10$, correct to two decimal places.

Estimate two integer values for x that will result in an answer that is close to 10. More specifically, one above and one below.

For example, choose $x = 3$ and $x = 4$ we get $2^3 = 8$ and $2^4 = 16$

Since the answer of 8 is closer to 10 than the answer of 16, we will use 3 as the first digit in our x-value. Thus, our answer will be 3.

Now we have to estimate what the first decimal place would be. Use trial and error to get an x-value that produces an answer as close to 10 as you can get. ie. if we choose 3 and 4 as the first decimal place we get:

Test value for x	Power	Approximate value
3.3	$2^{3.3}$	9.849
3.4	$2^{3.4}$	10.556

9.849 is closer to 10 than the other answer, so we will go with 3 as our first decimal place.
Now we must choose a number to use as the second decimal place.
Try values of 1, 2 and 3:

3.31	$2^{3.31}$	9.918
3.32	$2^{3.32}$	9.987
3.33	$2^{3.33}$	10.056

$2^x = 10 \quad 2^x = 2^{3.32} \quad x = 3.32$

The answer 9.987 is closest to 10, so we choose 2 as our second decimal place. Thus x is approximately 3.32.

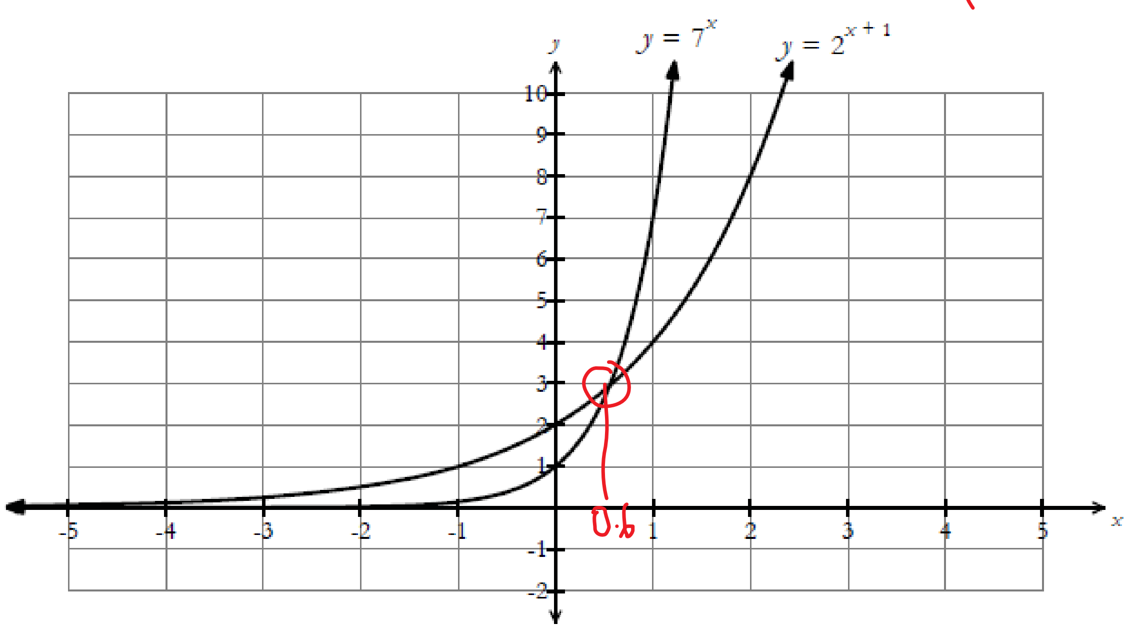
When we do the next chapter on Logarithms, we will learn a more fixed method for solving these types of problems, and you will probably opt to use that method instead of trial and error. However trial and error is useful in that it will allow us to check the reasonability of the answers that we get later using logarithms.

Solving an Exponential Equation Graphically

Example 2:
Use the graph to solve:

$$7^x = 2^{x+1}$$

$x = 0.6$



Textbook Questions: page 363 #8 b, c