Notes for 4.2 Exponential Functions (pp. 402 – 414)

Name:
Date:
Instructor:

I. Exponents and Their Properties (pp. 402 – 404)

Def. An **exponential function** has its variable as an exponent.
It is written as $f(x) = a^x$, where a > 0, a $\neq$ 1 and x is any real number.
Ex. Recall: $x^3 = 8$ vs. $2^x = 8$ is an exponential equation.

*Calculator reminders:
To put an exponent into the calculator, use the ^ key. If the exponent is a fraction, you must put parentheses around the entire fraction so that the calculator will "see" the entire exponent.

Ex. $2^{3.14}$ = 2 ^ 3.14 ENTER and $2^{\frac{3}{2}}$ = 2 ^ (3 / 2) ENTER
Ex. If $f(x) = 2^x$, find f(-1), f(3), f (5/2), f(4.92) Use calculator.

Recall Properties of Exponents:
1. $a^m \bullet a^n = a^{m+n}$
2. $\left(a^m\right)^n = a^{mn}$
3. $a^0 = 1$
4. $a^{-m} = \dfrac{1}{a^m}$
5. $1^{anything} = 1$

II. Exponential Functions (pp. 404 – 407)

A. For $f(x) = a^x$,where $a > 1$. (p. 405) Ex. $f(x) = 2^x$. Graph is an upwards swoop.

Characteristics of the exponential when a (the base) > 1:
1. Domain: $(-\infty, \infty)$ and Range: $(0, \infty)$ graph lies on top of the x-axis.
2. Graph has no x intercept because it doesn't cross the x axis… only approaches it.
3. Graph has a y intercept at (0, 1), since $2^0 = 1$ (in fact, $a^0 = 1$, so that point is on all exponential functions!!)
4. Graph is increasing.
5. Graph is continuous.
6. Any graph contains the points (0, 1), (1,a), and (-1, $\frac{1}{a}$).
7. The larger the value of the base, the steeper the graph.

B. For $f(x) = a^x$, where $a < 1$ (fraction base) Ex. $f(x) = \frac{1}{2}^x$; $g(x) = \frac{2}{5}^x$ Graph is a downwards swoop.

Characteristics of an exponential, where the base (a) is < 1:

1. Domain: $(-\infty, \infty)$ and Range: $(0, \infty)$ graph lies on top of the x-axis.
2. Graph has no x intercept because it doesn't cross the x axis… only approaches it.
3. Graph has a y intercept at (0, 1).
4. Graph is **decreasing**.
5. Graph is continuous.
6. Any graph contains (0, 1), (1, a) and (-1, $\frac{1}{a}$).
7. The smaller the value of a, the steeper the graph.

Translations still work.

p. 407, Ex. 3

x	2^x	-2^x	2^{x+3}	$2^x + 3$
-3				
-2				
-1				
0				
1				
2				
3				

III. Solving Exponential Equations (pp. 407 - 408)

1. This type of exponential uses the property that if $a^m = a^n$ (the bases are the same), then $m = n$ (the exponents will be the same.

Ex. $3^{x+1} = 81$

Since 81 = 3^4, we can write the equation as $3^{x+1} = 3^4$

Now that the bases (3) are the same, then $x + 1 = 4$

And $x = 3$

Ex. $5^{2x-7} = \frac{1}{5}$

$5^{2x-7} = 5^{-1}$ (recall that a negative exponent will take care of a fraction)

$2x - 7 = -1$

$2x = 6$

$x = 3$

Omit p. 408, Example 6.

IV. Compound Interest (pp. 408 – 410)

Compound interest has a time frame associated with it (annually (1), semiannually(2), quarterly(4), monthly(12), daily(365). It has a one-time deposit, with the interest figured every time period.

The formula is: $A = P\left(1+\frac{r}{m}\right)^{tm}$, where A = Future Value, P = Present Value or Principal, r = rate (written as a decimal), m = number of compounding periods in the time frame (above), and t = time in years (so 6 months = ½ for time).

*Calculator Hint: Put the ( ) info to the power that you get when you do the easy multiplication in your head for the exponent, then ENTER. Then, multiply that by the Principal. Don't try putting it in as it's written… too many ( ) to trip you up getting it from that direction.

*Calculator Hint: Enter the ( ) first, then ENTER to make the calculator catch its breath and get that answer… then multiply or divide by the Principal or Future Value.

*Calculator Hint: When dividing to get the Principal alone, use 2^{nd} (-) to get the ANS pasted where you want it. Should look like 1000 / ANS.

Ex. (p. 409, Ex. 7)

P = _______________; r = __________; m = __________; t = _____________

*Write the formula every time, so you'll do the correct substitution.

Ex. (p. 415, #63a)

P = ________________; r = __________; m = _________; t = __________

Continuously compounded interest runs the compounding times faster and faster and faster, until it get to be "instantaneous". The formula is: $A = Pe^{rt}$, where A = Future Value, P = Present Value or Principal, r = rate as a decimal, and t = time in years. The *e* is that number 2.71828 that the ( ) always settles to…(demo in video).

Ex. For an investment of $1000 at 4% for 10 years, compare the different amounts earned when it is compounded in the chart below:

Compoundings	$1	$1000
Annually		
Semiannually		
Quarterly		
Monthly		
Daily		
Continuously (use different Formula)		

Assignments:
Text: pp. 414 – 417#1 – 21 every other odd, 33, 38, 39 – 55 odd, 71, 73, 75ab, 77 - 80