BIG PICTURE of this UNIT:	• How do we WORK WITH & EXTEND the concept of "functions" • Why are exponential equations written in different forms? • How do we EXTEND our knowledge of exponential functions, beyond the basics of IM2?

This lesson will be based upon a STUDENT DIRECTED DISCUSSION model ….. in your groups, you should be having DISCUSSIONS about how to think and work through and then present the solutions to the following questions. The questions will involve basic ideas from IM2 including (i) exponential functions, (ii) functions in general, (iii) linear functions, and (iv) number patterns. EVERY LESSON this semester will involve **spiralling through** these 4 major concepts as you will be given the opportunity to deepen and extend your conceptual knowledge & skill set on these 4 major themes as you see them multiple times in our lessons.

So, in your group, discuss & prepare solutions to the following questions. Record the key ideas of your discussions/solutions in your notebook. Then, once you have had your discussions, present your solutions on the board. Solutions do NOT necessarily NEED to be correct – they simply form the basis for DISCUSSIONS !!!! If your group has (i) multiple solutions that lead to the same answers OR (ii) same/different solutions that lead to different answers, present them ANYWAY!!

1. (**CI**) Given the function $f(x)=\left(\frac{1}{2}\right)^x$, prepare a table of values (using x = -3, -2, -1, 0, 1, 2, 3) and then prepare a graph of $f(x)=\left(\frac{1}{2}\right)^x$. Label the intercept(s) and show the horizontal asymptote (include its equation). State the range if the domain of $f(x)=\left(\frac{1}{2}\right)^x$ was infinite: $\{x \in R\}$. How is this graph **different** than tbe graph of $f(x)=2^x$? How does this graph compare to that of $y=f(-x)$? {8,9}

2. (**CI**) The graph of $f(x)=\left(\frac{1}{2}\right)^x$ is now translated left by 3 and down by 4. {8,9,17}

   a. List the new ordered pairs of the translated curve for $f(x)=\left(\frac{1}{2}\right)^x$.

   b. Label the intercept(s) and show the horizontal asymptote (include its equation).

   c. Determine the new range if the domain of the original $f(x)=\left(\frac{1}{2}\right)^x$ was infinite: $\{x \in R\}$.

   d. Determine the new range if the domain of the original $f(x)=\left(\frac{1}{2}\right)^x$ was $\{-4 \le x \le 4\}$.

   e. Explain why Mr S knows that the equation for the new function has to be $g(x)=\left(\frac{1}{2}\right)^{x+3}-4$.

3. Evaluate the following expressions: {1}

$(a)\ 49^{\frac{1}{2}} + 16^{\frac{1}{4}}$ $\quad (b)\ \left(16^{\frac{1}{2}}\right)^{3} + 16^{-0.5}$ $\quad (c)\ \left(2^{2} \times 5\right)^{-1}$

$(d)\ \left(\frac{3^{-1}}{2^{-1}}\right)^{-2}$ $\quad (e)\ \left(5^{0} \times 5^{4} \div 5^{3}\right)^{-4}$ $\quad (f)\ 4^{\frac{1}{2}} + (-8)^{\frac{1}{3}} \times \left(\frac{1}{16}\right)^{\frac{1}{2}}$

4. TERMINOLOGY: Use internet resources to define and thus to explain the difference between the following terms: (i) base, (ii) power, (iii) exponent. In the equation $2^3 = 8$, label the base, the power and the exponent. {2}

5. Use your TI-84 (KEY: use math 5 on your TI-84) to work through the following evaluations: {1,3}

   a. Exponents vs Roots

Exp	$8^{\frac{1}{3}}$	$16^{\frac{1}{4}}$	$20^{\frac{1}{5}}$	$100^{\frac{1}{10}}$	$8^{\frac{2}{3}}$	$50^{\frac{3}{4}}$
roots	$\sqrt[3]{8}$	$\sqrt[4]{16}$	$\sqrt[5]{20}$	$\sqrt[10]{100}$	$\left(\sqrt[3]{8}\right)^{2}$	$\left(\sqrt[4]{50}\right)^{3}$

   b. Explain what it means to take the *n*th root of a number.

6. What is the average annual rate of inflation if a loaf of bread cost \$1.19 in 1991 but costs \$1.50 in 2001? What assumptions are you making in creating your solution?{4,20}

7. In 1996, the population of Germany was 84 million and the population of Egypt was 64 million. If the populations of Germany and Egypt grow at annual rates of -0.15% and 1.9% respectively, when will Egypt have a greater population than Germany? {11,20}

8. Exponent Laws question ➔ work through ANY 20 of the following practice Qs.

EXPONENTS PRACTICE

Simplify:

1. $3 \cdot 4^3$
2. $4x^3 \cdot 2x^3$
3. $x^5 \cdot x^3$
4. $2x^3 \cdot 2x^2$
5. $\frac{6^5}{6^3}$
6. $\frac{x^4}{x^7}$
7. 8^0
8. $-(9x)^0$
9. $(y^4)^3$
10. $(x^2y)^4$
11. $\frac{6x^7}{2x^4}$
12. $\frac{8x^5}{4x^2}$
13. $(2cd^4)^2(cd)^5$
14. $(2fg^4)^4(fg)^6$
15. $\frac{x^5y^6}{xy^2}$
16. $\frac{x^2y^5}{xy^4}$
17. $\left(\frac{4x^5y}{16xy^4}\right)^3$
18. $\left(\frac{5x^3y}{20xy^5}\right)^4$
19. y^{-7}
20. 7^{-2}
21. $\frac{1}{x^{-5}}$
22. $\frac{1}{2^{-4}}$
23. $x^5 \cdot x^{-1}$
24. x^{-6}
25. $x^9 \cdot x^{-7}$
26. $(j^{-13})(j^4)(j^6)$
27. $\frac{x^{-1}}{x^{-8}}$
28. $\frac{52x^6}{13x^{-7}}$
29. $f^{-3}(f^2)(f^{-3})$
30. $\frac{x^{-4}}{x^{-9}}$
31. $\frac{24x^6}{12x^{-8}}$
32. $\frac{3x^2y^{-3}}{12x^6y^3}$
33. $(2x^3y^{-3})^{-2}$
34. $\frac{2x^4y^{-4}}{8x^7y^3}$
35. $(4x^4y^{-4})^3$
36. $5x^2y(2x^4y^{-3})$
37. $\left(\frac{-7a^2b^3c^0}{3a^3b^4c^3}\right)^{-4}$
38. $\left(\frac{-2a^3b^2c^0}{3a^2b^3c^7}\right)^{-2}$

Higher Level Questions for More Complex Concepts OR an EXTENSION of basic concepts involved with Exponential and Logarithmic Functions.

1. Jayne puts \$5,000 in an investment that earns 9% simple interest. How much will she have at the end of:

   a. One year? b. Two years? c. Three years? d. *n* years?

2. Jayne puts in \$5,000 in an investment that earns 9% interest compounded annually. How much will she have at the end of :

   a. One year? b. Two years? c. Three years? d. *n* years?

3. Jayne puts in \$5,000 in an investment that earns 9% interest. How much does she have at the end of 1 year if the interest is compounded:

   a. Annually? b. quarterly? c. monthly? d. daily? e. by *n* evenly spaced times per year?