Name:________________________ Class #:______

Math 48A, Lesson 1
Popular Classes of Function

1.	LINEAR FUNCTION	TYPE OF POWER FUNCTION

What do you remember about the equation for a line? Please talk with your group and come up with as much as possible

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2. ABSOLUTE VALUE FUNCTIONS

How might we read the following statement:

$$f(x) = |x|$$

What does this notation mean?

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3. QUADRATIC FUNCTIONS TYPE OF POWER FUNCTION

How might we read the following statement:

$$f(x) = x^2$$

What does this notation mean? See page 4 of this worksheet for some hints.

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4. How might we read the following statements? What does the notation mean? If possible, try to name the type of function using nerdy language. The first one is done for you 😁.

Statement	How to read?	What does it mean?
$f(x) = x^3$	"f of x equals x cubed" "f of x equals x to the third power" "f of x equals x to the power of three"	Multiply the input x by itself two times to get output. $f(x) = x^2 = x \cdot x$ My inner nerd 🤓 would call this a quadratic function.
$f(x) = x^4$		
$f(x) = x^5$		

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5.	POWER FUNCTIONS	NOT EXPONENTIAL FUNCTIONS INVERSE OF ROOT FUNCTIONS

Let's explore power notation. How might we read the following statement:

$$f(x) = x^n \quad \text{for} \quad n \in \mathbb{N}$$

What does this notation mean? What are the special features of this notation?

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6.	SQUARE ROOT FUNCTION	TYPE OF ROOT FUNCTION INVERSE OF x^2

How might we read the following statement:

$$f(x) = \sqrt[2]{x}$$

What does this notation mean? See page 7 of this worksheet for some hints.

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7. How might we read the following statements? What does the notation mean? If possible, try to name the type of function using nerdy language. The first one is done for you 😁.

Statement	How to read?	What does it mean?
$f(x) = \sqrt[3]{x}$	"f of x equals the cube root of x" "f of x equals the third root of x" "f of x equals x to the one third power"	Find a output y such that when we multiply that output by itself three times we get input x $y = \sqrt[3]{x} \iff y^3 = x$ My inner nerd 🤓 would call this a cube root function.
$f(x) = \sqrt[4]{x}$		
$f(x) = \sqrt[5]{x}$		

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8.	ROOT FUNCTIONS	AKA RADICAL FUNCTIONS INVERSE OF POWER FUNCTIONS

Let's explore root notation (also known as radical notation). How might we read the following statement:

$$f(x) = \sqrt[n]{x} \quad \text{for} \quad n \in \mathbb{N}$$

What does this notation mean? What are the special features of this notation?

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9. How might we read the following statements? What does the notation mean? If possible, try to name the type of function using nerdy language. The first one is done for you 😁.

Statement	How to read?	What does it mean?
$f(x) = \dfrac{1}{x}$	"f of x equals one divided by x" "f of x equals one over x" "f of x is a reciprocal function with one in numerator and x in the denominator"	To get output y take the number one and divide that number by the input x $y = \dfrac{1}{x}$ My inner nerd 🤓 would call this a rational function.
$f(x) = \dfrac{1}{x^2}$		
$f(x) = \dfrac{1}{x^3}$		

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10. RATIONAL FUNCTIONS AKA RECIPROCAL FUNCTIONS

Let's explore rational function notation (also known as reciprocal notation). How might we read the following statement:

$$f(x) = \frac{1}{x^n} \quad \text{for} \quad n \in \mathbb{N}$$

What does this notation mean? What are the special features of this notation?

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11. What does the word “ratio” mean? Can you give an example of a ratio of two numbers? Look back at your work on problem 10. How does this relate to the idea of a ***ratio***nal function?

12. How might we read the following statements? What does the notation mean? If possible, try to name the type of function using nerdy language. The first one is done for you 😁.

Statement	How to read?	What does it mean?
$f(x) = 2^x$	"f of x equals two to the x" "f of x is an exponential function with base two and exponent x" "f of x equals two multiplied by itself x times"	Find an output y created by multiplying based 2 by itself x times $y = 2^x$ My inner nerd 🤓 would call this an exponential function.
$f(x) = 3^x$		
$f(x) = 4^x$		

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13.	EXPONENTIAL FUNCTIONS	NOT POWER FUNCTIONS INVERSE OF LOGS

Let's explore root notation (also known as radical notation). How might we read the following statement:

$$f(x) = a^x \quad \text{for} \quad a \in \mathbb{R} \text{ with } a > 0$$

What does this notation mean? What are the special features of this notation?

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14. How might we read the following statements? What does the notation mean? If possible, try to name the type of function using nerdy language. The first one is done for you 😁.

Statement	How to read?	What does it mean?
$f(x) = \log_2(x)$	"f of x equals log base 2 of x" "f of x is a logarithmic function with base two and input x" "f of x equals log to the base two of x"	Find a output y such that when we multiply that output by itself three times we get input x $y = \log_2(x) \Leftrightarrow 2^y = x$ My inner nerd 🤓 would call this a log base 2 function.
$f(x) = \log_3(x)$		
$f(x) = \log_4(x)$		

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15. LOGARITHMIC FUNCTIONS — INVERSE OF EXPONENTIALS

Let's explore root notation (also known as radical notation). How might we read the following statement:

$$f(x) = \log_a(x) \quad \text{for} \quad a \in \mathbb{R} \text{ with } a > 0$$

What does this notation mean? What are the special features of this notation?

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Lesson 1 Quiz: Test Your Memory

In this class, we will focus on our energy on learning to describe different classes of functions known as elementary functions. The foundations you set in this class will support you for the rest of your career in mathematics. Using the work you did on questions 1 – 15, try to match the given algebraic statements with the nerdy names for these statements.

Linear function____________ A. $f(x) = 2 + \log_{10}(x - 1)$

Quadratic function_________ B. $f(x) = \frac{8}{x^2 - 4}$
(Hint: in Spanish, the word Cuadro means square)

Absolute value function___________ C. $f(x) = 3 + 2^x$

Rational function__________ D. $f(x) = 3 + \sqrt[2]{x - 1}$
(aka reciprocal function)

Power function____________ E. $f(x) = x^2 + 6x + 9$

Root function____________ F. $f(x) = 3x - 2$

Exponential function_________ G. $f(x) = 2x^5 - 4$

Logarithmic function_________ H. $f(x) = 2 \cdot |1 - 2x| - 4$

Please see the next pages for some ideas about in-class timed exams.

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Goal for this class:

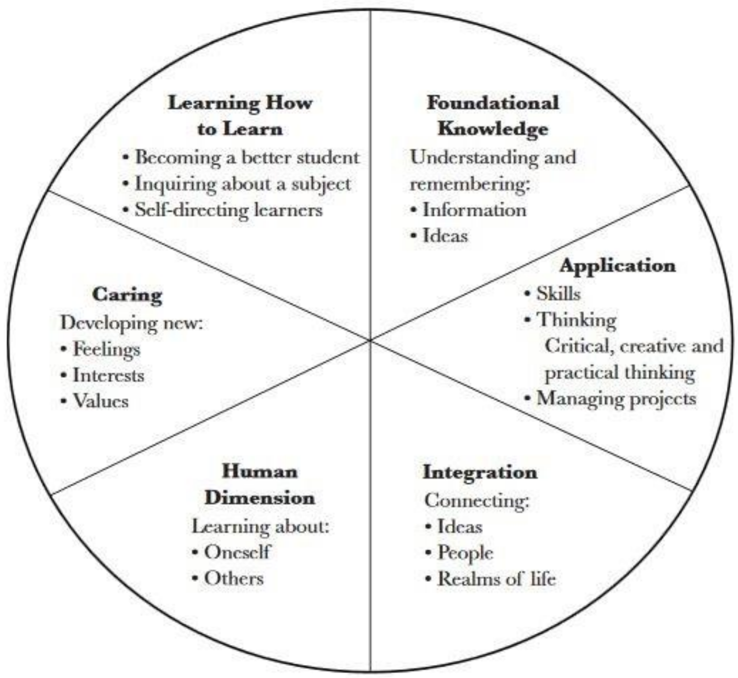
Focus on creating significant learning experiences.

Let's take a look at page 1 of our course syllabus. Notice that in my note to you on that page, I say:

> "My primary goal is to inspire, encourage, support, and guide you to create significant learning experiences in this class."

To understand more about what I mean by that statement, let's take a look at page 7 of our course syllabus. At that top of that page is the question "what are the major categories of significant learning experiences?" Read through the descriptions of each of the major categories. Compare those descriptions with the diagram below.

FIGURE TAXONOMY OF SIGNIFICANT LEARNING.



When considering all 6 categories of significant learning, I believe that learning how to learn is by far the most important aspect of your time in this course. If you are lucky enough to create a career in which you rely heavily on theory from this class, you will likely need to learn a bunch of ideas outside the content of this course to effectively solve problems using this theory. In fact, if you plan on being paid to do knowledge work, your future career will be filled with continual learning and reflection. This reality is part of the information age.

Only as a lifelong learner will you be able to keep up with our society's explosive growth of knowledge, develop new skills that you may need to accomplish your goals, and explore new directions in your career. The need to consistently reflect on your circumstances, retool your professional credentials, and develop new skill sets is already the norm for our generation and future generations to follow. The ability to learn effectively and to monitor your learning habits is fundamentally important as a basic economic survival skill.

I believe you can learn anything. You can develop any skills and cultivate any abilities. When you work hard, use effective learning strategies, persist in the face of difficulties, and reflect on your progress, you can become anything you want. With this in mind, I will work with you to develop strategic deep learning skills. Much of the work I provide you will guide help you develop professional learning skills in the U.S. higher education system while strategically navigating your degree pathway. My hope is that as we do this work together, you will come to believe in yourself as much as I believe in you. You can become an intentional, independent, self-regulated learner. And we are going to build a community around you to help!

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System-navigation skill:

Recognize and remind yourself frequently that grades on in-class timed exams do NOT measure learning.

In-class timed exams do not measure learning. They measure your ability to recall facts, manage your anxiety, and use test-taking strategies. They also measure your ability to solve problems under time pressure.

Let me share some stories to explain a little more. I (Jeff) have earned many A grades on in-class time exams while knowing very little about the actual content. In fact, the learning I did to earn those grades was shallow. I can remember at least one exam where I got a 93/100 and understood almost nothing about the material.

The same reality exists for F grades. I (Jeff) have gotten an F on an exam for a class where I learned very deeply. I didn't finish the exam because I wrote a lot about a single problem and forgot about the rest of the test.

Let's spin this out a little more using a thought experiment. I (Jeff) have a BS, MA, and PhD in mathematics. I studied math at university for 9 years and have taught Math at Foothill College for 8 years. I've written two textbooks and published multiple academic mathematical articles. And yet, I could take almost any exam in any math class at Foothill College and get an F (a 0%). I simply could turn it in without writing a single word. Does that mean that I am bad at math? Or, perhaps I might turn in an exam with all the wrong answers on purpose. Does that mean I don't know what I'm doing?

Remember, if you do poorly on a test, tell yourself: I am intelligent, I am smart, I am hella good at math. Then use effective help-seeking practices and learning techniques to improve your performance on future exams. We'll explore more about such practices throughout our work together.

Most math teachers are content experts (math nerds). Very few of the math teachers that I have had spent dedicated time studying how learning works. Our college education system is designed in such a way that your math professors can get jobs without understanding much about the science of learning nor about how to develop effective teaching practices to inspire significant learning that achieve equitable outcomes. That is a policy problem. One cruel feature of that set of policies is that the burden is placed on your shoulders. In this class, our team is going to share that burden.

System-navigation skill:

When you make mistakes on an in-class timed exam, complete your exam correction process as soon as you can. Then, make an appointment in office hours to talk with your teacher about your corrections and get guidance on the next steps.

Any time you make a mistake on a math test, that is an indication of your intelligence and hard work. The more mistakes you make, the better you become. The fact that our system punishes you for those mistakes is stupid, anti-productive, harmful and unjust. Don't fall into that trap. We'll talk more about how to do exam corrections in the future.