Week 3
Term 1
2024

HAWKER COLLEGE
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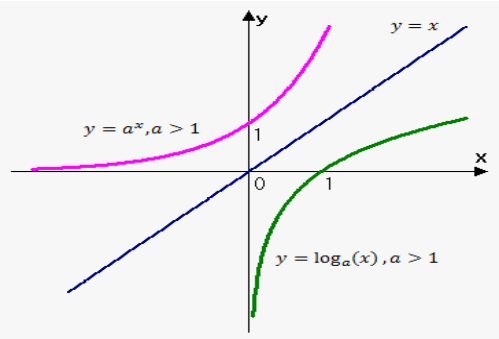
SMM3

Goals



This week we are going to:

- Further graphing logarithmic functions, showing necessary features, including domain and range
- Using exponential and logarithmic modelling

Theoretical Components

Make notes on the following chapters:

Maths Quest 12 Mathematical Methods

- 3G - Inverses
- 3H - Literal equations
- 3I - Exponential and logarithmic modelling

What is base e?

Learn more about Euler's number. Read through to get an insight on the number 'e':

- https://www.mathopolis.com/questions/q.php?id=2011&site=1&ref=/numbers/e-eulers-number.html&qs=2011_2012_2013
- https://betterexplained.com/articles/an-intuitive-guide-to-exponential-functions-e/

Graphing Logarithmic Functions:

- https://www.youtube.com/watch?v=q9DhlR43P7A
- https://www.youtube.com/watch?v=LqyA96oYtwE

Practical Components

Do the following questions:
Organise your solutions neatly in your exercise book.

Chapter 3 of Maths Quest 12 Mathematical Methods (pdf – Google Classroom)

- 3G: all
- 3H: all
- 3I: all

Portfolio Task

See next page

Other

Make sure you have joined the Google Classroom. If you have not, see your teacher.

Fun fact: Before computers and calculators were invented, people used logarithm tables to assist with their hand calculations. Tables of base-10 logarithms were commonly provided in mathematical and scientific textbooks, allowing one to easily convert complicated multiplication and division calculations to simple addition and subtraction (think about how much work is involved in long division!)

Week 3 Investigation

To prove that functions are inverses of each other. You will compose the functions (substitute x into one function, then substitute that function into the inverse function and simplify) and verify that you end up with x.

Example: Determine algebraically whether $f(x) = 3x - 2$ and $g(x) = \frac{x+2}{3}$ are inverses of each other.

First substitute the formula for $g(x)$ into every instance of x in the formula for $f(x)$:

$$f\big(g(x)\big) = f\left(\frac{x+2}{3}\right)$$
$$f\big(g(x)\big) = 3\left(\frac{x+2}{3}\right) - 2$$
$$f\big(g(x)\big) = (x+2) - 2$$
$$f\big(g(x)\big) = x$$

Substitute the formula for $f(x)$ into every instance of x in the formula for $g(x)$:

$$g\big(f(x)\big) = g(3x-2)$$
$$g\big(f(x)\big) = \frac{(3x-2)+2}{3}$$
$$g\big(f(x)\big) = \frac{3x}{3}$$
$$g\big(f(x)\big) = x$$

Both substitutions equal to x, therefore $\boldsymbol{f(x)}$ **and** $\boldsymbol{g(x)}$ **are inverses of each other.**

If it doesn't end up with x, then the two equations are not inverses of each other.

Question:

1. Use the same method to prove $y = e^x$ and $y = \log_e(x)$ are the equations of inverse functions.
2. Use ***graphical*** methods to show that $y = e^x$ and $y = \log_e(x)$ are inverses of each other.