Week 3/4
Term 1
2020

HAWKER COLLEGE
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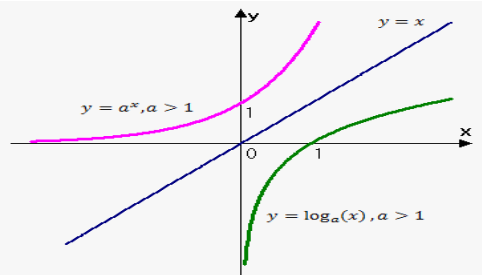
SMM3
Logarithmic Functions and Further differentiation and applications

Goals



This week:

- Solving indicial and logarithmic equations using any base
- Investigate Euler's number
- Use natural logarithms to the base e. Learn notation used.
- Further graphing logarithmic functions, showing necessary features. Domain and range
- Using exponential and logarithmic modelling

Theoretical Components

STEP 1

What is base e?

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

http://www.mathopolis.com/questions/q.php?id=2011&site=1&ref=/numbers/e-eulers-number.html&qs=2011_2012_2013
Watch:
http://bit.ly/w8OiD

Graphing Logarithmic Functions

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

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

Domain and Range of Logarithmic Functions
https://mathspace.co/teach2/chapter/33888/1451/

Natural Logarithms
https://mathspace.co/teach2/chapter/33893/1455/

See summary notes on the following page.

Practical Components

STEP 2

Do **Exercise 3C, 3D, 3E**. (Handout). Do as many as you need to become proficient at these skills and concepts.

Exercises 3F and 3G (Handout)
Do as many as you need to become proficient at these skills and concepts.

Investigation

STEP 3

1. Question 7 Exercise 3E, page 105
2. By reflecting the graph of $y = e^x$ in the line $y = x$, obtain a sketch of the curve $y = log_e x$. Show that $e^{ln\,a} = lne^a$

remember

1. Euler's number e is an irrational number which is approximated to 2.718 (3 decimal places).
2. Evaluate e by using the 'e^x' button on the calculator.
3. The number e is an exact answer, whereas the calculator gives an approximation.
4. The laws of indices apply in the same way if e is the base.
5. Use the LN button to take the log of a number to base e. The LOG button means $\log_{10}$.
6. $\log_e x = \ln x$.
7. $e^x > 0$, that is, $e^x = -1$ has no real solution.

remember

1. The equations $a^x = y$ and $2^x = 32$ are indicial equations.
2. Write numbers with the same base to help simplify problems. The most common ones to use are 2, 3 and 5.
3. If the base is the same equate the indices.
4. If the indices are the same equate the bases.
5. Use the Null Factor Law to solve quadratic equations.
6. A negative number cannot be expressed in index form, for example, -4 cannot be expressed with base 2.
7. $a^{2x} = (a^x)^2$
8. Take the logarithm of both sides of an equation or inequation using the same base.
9. Change the sign of an inequality when multiplying or dividing by a negative number.
10. $\log_a x > 0$ if $x > 1$
11. $\log_a x < 0$ if $0 < x < 1$

REMEMBER

1. $f(x) = \log_a(x)$ is the inverse of $g(x) = a^x$ and they are therefore reflections of each other through the line $y = x$.
2. If $a > 1$, $f(x) = \log_a(x)$ has:
   - x-intercept $(1, 0)$
   - asymptote $x = 0$
   - domain $= R^+$
   - range $= R$.
3. The graph of $f(x) = \log_a(x + b) + c$ is obtained by translating the graph of $f(x) = \log_a(x)$ b units horizontally and c units vertically.