Week 7/8
Term 3
2023

HAWKER COLLEGE
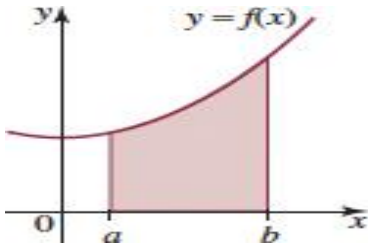Engage | Inspire | Achieve

MM4
Calculus of Log
Functions

Goals

By the end of this brief, you should be able to:
- Review the chain rule for differentiation of exponential functions of the forms: $y = e^x$, and $y = e^{f(x)}$
- Find the derivatives logarithmic functions of the forms; $y = ln(x)$ and $y = ln[f(x)]$.
- Use derivatives to solve practical problems
- Use further applications of differentiation
- **Integrate** to give log functions
- Find an exact area under a given curve using definite integrals
- Use further applications of integration
- Review for Week 8/9 test

Theoretical Components

Read and make notes on examples 4, 5 and 8 from Chapter 9 (pdf – Google Classroom)

Videos
Integral of natural log
https://youtu.be/JMqKtEC2bbY

Area under ln(x) curve (using inverse function)
https://www.youtube.com/watch?v=rjKnN6wJSuc

Summary of integrals

$f(x)$	$\int f(x)\, dx$
a	$ax + c$
ax^n	$\dfrac{ax^{n+1}}{n+1} + c$
$(ax+b)^n$	$\dfrac{(ax+b)^{n+1}}{a(n+1)} + c$
$\dfrac{1}{x}$	$\log_e |x| + c$
$\dfrac{1}{ax+b}$	$\dfrac{1}{a}\log|ax+b| + c$
e^x	$e^x + c$
e^{kx}	$\dfrac{1}{k}e^{kx} + c$
$\sin(ax)$	$\dfrac{-1}{a}\cos(ax) + c$
$\cos(ax)$	$\dfrac{1}{a}\sin(ax) + c$

Practical Components

Do the following questions from **Chapter 9: Logarithmic functions using calculus** (pdf – GC). Organise your solutions neatly in your exercise book.

Ex 9.3 The antiderivative of $f(x) = \dfrac{1}{x}$
Qs 1, 3, 5, 7, 10, 12, 19

Ex 9.4 Applications
Qs 1, 3, 6, 9, 10, 11 (do more questions if you like)

The fundamental theorem of calculus is $\int_a^b f(x)\, dx = [F(x)]_a^b$
$$= F(b) - F(a).$$
where $F(x)$ is an antiderivative of $f(x)$.

Investigation

See the following pages.

QFO
Quiz/Forum/Other

Revise for your test. Create a two-sided handwritten A4 summary sheet to be submitted with the test.

Ensure you have completed all classwork, investigations and Mathspace tasks.

Check out the chapter reviews for revision.

Prepare a summary sheet for use in the test (two-sided hand-written A4 page).

Knowledge Checklist:

Logarithmic functions
- Index laws
- Logarithmic laws
- Exponential equations
- Logarithmic equations using any base
- Exponential equations (base e)
- Equations with natural (base e) logarithms
- Inverses
- Exponential and logarithmic modelling

Calculus of log functions
- The derivative of $f(x) = \log_e(x)$
- The anti-derivative of $f(x) = \frac{1}{x}$
- Applications

Bivariate data
- Dependent and independent variables
- Back-to-back stem plots
- Parallel boxplots
- Scatterplots
- Correlation coefficient
- Coefficient of determination

MM4 Investigation Week 7 and 8

If $y = \ln(x)$, explain how you would find the area under the curve from $x = 1$ to $x = 3$. Find the area. Give your answer in exact form and to 4 decimal places.