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Warning

CHARLES DARWIN UNIVERSITY

Family Name	
Given Names	
Student Number	
Teaching Period	Semester 1, 2016

FINAL EXAMINATION	**DURATION**
ECM262 – Teaching the Curriculum: Maths 2	Reading Time: **10** minutes Writing Time: **120** minutes

INSTRUCTIONS TO CANDIDATES

There are three sections to this exam. You need to answer all three.

- **Section A** deals with your basic and senior mathematics content knowledge.
- **Section B** deals with writing model solutions. You need to answer any two, out of four questions in this section.
- **Section C** is concerned with your pedagogical content knowledge and assessment of students' work.

Please note that under the authorised materials, Lecture Text books include any Senior Maths Text Book.

EXAM CONDITIONS

This is a RESTRICTED OPEN BOOK examination

Any calculator is permitted

One A4 sheet of handwritten double-sided notes permitted

Any hard copy, unannotated dictionary is permitted

Answer on both exam paper and supplied material/s

ADDITIONAL AUTHORISED MATERIALS	EXAMINATION MATERIALS TO BE SUPPLIED
Lecture Textbook/s (Unannotated)	1 x 8 Page Book
Lecture Notes (Unannotated)	Graph Paper

THIS EXAMINATION IS PRINTED DOUBLE-SIDED.

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Section A
Multiple Choice Questions
(Basic and Senior Mathematics Content Knowledge)

Please ensure that your name and student number have been written on the Answer Booklet.
Almost all the questions in the paper should be answered on the question paper itself. However, if you need some extra space you use the answer booklet to write your answers.

Marks for each question are indicated.
Suggested Time allocation for Section A: 40 minutes
Total No of Marks for this section: 28

Section B
Short Answer Questions
(Writing model solutions)

Marks for each question are indicated.
Suggested Time allocation for Section A: 25 minutes
Total No of Marks for this section: 14

Write model solutions for **any two** of following four questions **in this section** , assuming these be given to the students to emphasize the importance of communicating mathematically when presenting their solutions

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Question 1

Find $\frac{dy}{dx}$ for each of the following functions. There is no need to simplify your answers.

(a) $y = (x^2 - \frac{2}{x})^3$

Formula

Step 1

Step 2

Answer

(3 marks)

(b) $y = \frac{\ln x}{1 - e^{-x}}$

Formula

Step 1

Step 2

Answer

(4 marks)

Question 2

Consider $D = \begin{bmatrix} 2 & k & k^2 \\ 0 & -1 & k \\ -2 & 1 & 0 \end{bmatrix}$

(a) Evaluate the determinant of D

Formula

Step 1

Step 2

Answer

(4 marks)

(b) Hence determine the value(s) of k for which the matrix D has no inverse.

Explanation:

When a matrix does not have an inverse?

Step 1

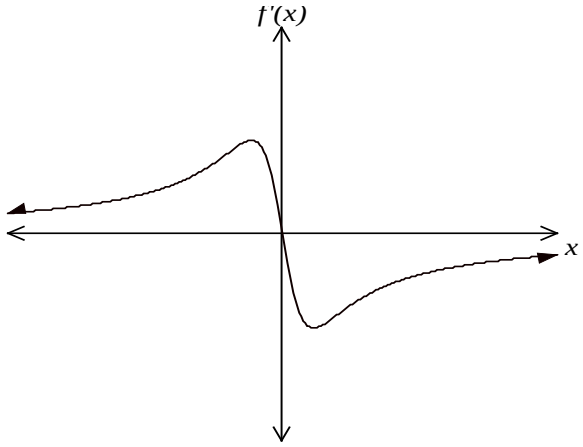
Step 2

Answer

(3 marks)

Question 3

The graph of the **derivative** $y = f'(x)$ is shown below:



(a) The graph passes through the origin *O*. What does this tell you about the graph of $y = f(x)$

Explanation:
Values of the (x,y) at origin; what does it mean in relation to the above graph
How it relates to y= f(x)

(3 marks)

(b) On the graph above, mark and label any points where (second derivative) $f''(x) = 0$ What do these points tell you about the graph of $y = f(x)$

Explanation:
What is the connection between graphs key points and derivative?

(4 marks)

Question 4

Consider the 'curve' $xy^2 - 2y - x^2 = 0$, where x and y are real numbers.

(a) Show that $\frac{dy}{dx} = \frac{2x - y^2}{2xy - 2}$

Formula
Derivative of implicit functions

Step 1

Step 2

Answer

(3 marks)

(b) Show algebraically that there are 2 points on the curve where $x = 2$. State the coordinates of each point, and find the slope of the curve at each point.

What happens *at x=2 Substitution in the equation*

Solving *the equation*

Writing *coordinates of points*

Connection *of dy/dx and slope*

Finding *the slopes*

(4 marks)

Section C
Create a response Questions
(Pedagogical knowledge and assessment of students' work)

Marks for each question are indicated.
Suggested Time allocation for Section A: 45 minutes
Total No of Marks for this section: 25

This section is about answering some of the student's queries, assessing their work and providing a suitable feedback to them

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Question 1
You have finished teaching a specific unit and about to begin teaching the topic of Calculus, how would you initiate, engage and motivate the study of this topic in your class.

(4 marks)

Question 2

a) A student asks you the meaning of Integral (as in Integral calculus), what it calculates? How would you respond?

b) Another student asks you why we need to memorize 'Times tables' in the age of calculators, mobile phones and other hand held electronic devices, when push of few buttons can give us the answer? How would you respond?

(3+3 marks)

Question 3

A student was given the task of solving the following equation

$$x^2 + 8x + 15 = 3$$

He proceeded with

$$x^2 + 8x + 15 = (x+3)(x+5)$$

Thus

$$(x+3)\,(x+5) = 3$$

Thus either

$$(x+3) = 3 \text{ and } (x+5) = 1$$

And hence $x = 0$ *or* -4

or $(x+3) = 1$ *and* $(x+5) = 3$ *which mean* $x = -2$

Thus the solutions are $x = -2, 0$ *or* -4

What is wrong with the solution and how would you explain the fallacy?

(5 marks)

Question 4

In an exam following question was given:

Solve $x^2 = 9x$

Two students produce subsequent pieces of working in response to the above question.

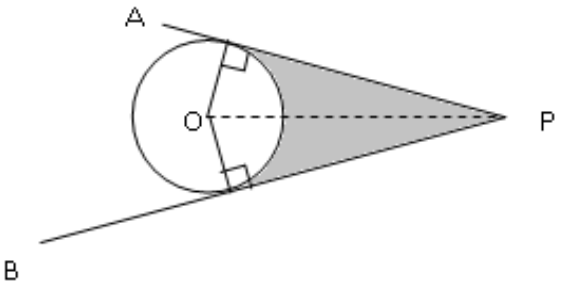
Student A	***Student B***
Divide both sides by x: $\frac{x^2}{x} = \frac{9x}{x}$ *Canceling common factors on each side of the equation:* $x = 9$ *Check: substituting x =9 into the equation shows it's a solution.*	*Subtract 9x from both sides:* $x^2 - 9x = 9x - 9x$ *thus* $x^2 - 9x = 0$ *Factorizing:* $x(x - 9) = 0$ *Thus using null factor law :* $x = 0$ *or* $x = 9$

Clearly one solution is not 'complete'. How would you explain it to the concerned student with a focus on what conceptual misunderstanding the student might be having?

(5 marks)

Question 5

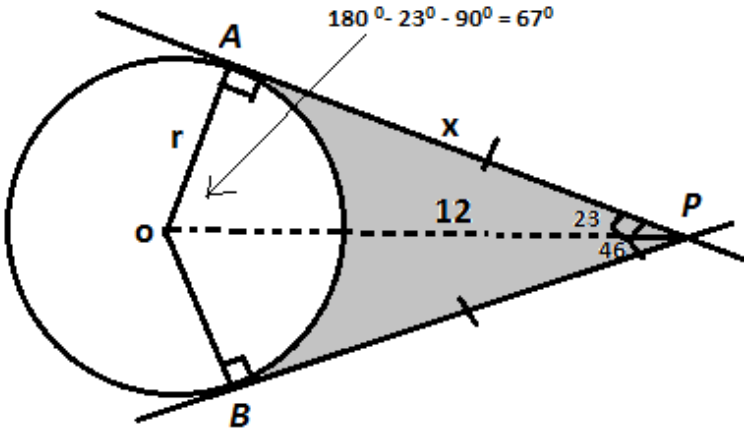
In the following diagram PA and PB are tangents to the circle, OP = 12 and $\angle$ APB = 46^0
Find the shaded Area



Following is the solution provided by a student. You need to assess the solution (mark the steps with a tick if correct, cross the steps that are wrong and write what went wrong and how to improve it next time, finally give a mark) .

(5 marks)

Solution:



$\sin 23 = \frac{r}{12}$

$r = 12 \sin 23$

$\doteq 4.69 \text{ cm}$

Area of Sector $= \frac{\text{Angle}}{360} \times \pi \times r^2$

$\therefore$ Area of sector $= \frac{67}{360} \times \pi \times 4.69$

$\doteq 12.9 \text{ cm}$

$x^2 + 12^2$

$12^2 = x^2 + r^2$

$x^2 = 12^2 - r^2$

$x = \sqrt{12^2 - 4.69^2}$

$= 11.0 \text{ cm}$

$\therefore$ A of $\Delta = \frac{1}{2} \times 12 \times 12 \times \sin 23$

$= 25.9 \text{ cm}^2$

or A of $\Delta = \frac{1}{2} \times 4.69 \times 12 \times \sin 67$

$= 25.9 \text{ cm}$

$\therefore$ A shaded $=$ A of sector + A of Δ

$= -12.9 + 25.9$

or

$25.9 - 12.9$

$= 13 \text{ cm}$

(4 marks)

Extra Space if needed