Supervision Instructions

Mathematics Methods (Unit 1-2)
Task #1
28th of February 2023 – Period 4

Task consists of two papers: **Paper 1** and **Paper 2**. Students will have access to only one paper at a time.

Paper 1:

- 15 minutes
- Calculator is not allowed

After 15 minutes **Paper 1** is to be collected and **Paper 2** will be given.

Paper 2:

- 25 minutes
- Calculator is allowed

After 25 minutes **Paper 2** is to be collected.

Check that students put their names.

2023 Mathematical Methods (Unit 1-2)
Task 1

Paper 1 – Calculator not allowed

Number of marks: 10
Writing time: 15 minutes

Name: Marking Guide Marks:

Instructions

Answer **all** questions in the spaces provided.
In all questions where a numerical answer is required, an exact value must be given unless otherwise specified.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1

2 marks

Solve for x where $x \in R \setminus \{1, 0\}$.

$$\frac{3}{2(x-1)} - \frac{1}{x} = \frac{1}{3x}$$

$\frac{3}{2(x-1)} = \frac{1}{x} + \frac{1}{3x}$

$\frac{3}{2(x-1)} = \frac{3+1}{3x}$ 1 mark

$9x = 4.2(x-1)$

$9x = 8x - 8$

$x = -8$ 1 mark

Question 2

2 marks

Simplify

$$\frac{a^2 - 9b^2}{(a-3b)^2} \div \frac{(a+3b)^2}{4a-12b}$$

$\frac{(a-3b)\cdot(a+3b)}{(a-3b)^2} \times \frac{4(a-3b)}{(a+3b)^2}$ 1 mark

$= \frac{4}{a+3b}$ 1 mark

Question 3 2 marks

Find the equation of the line, which passes through the point $(1,-\frac{1}{5})$, and is perpendicular to the line $2y-5x+8=0$.

$m=\frac{2}{5}$

$m=\frac{5}{2}$

$y+\frac{1}{5}=-\frac{2}{5}(x-1)$

1 mark

$y=-\frac{2x}{5}+\frac{2}{5}-\frac{1}{5}$

$y=-\frac{2x}{5}+\frac{1}{5}$ 1 mark

Question 4 2 marks

Solve for x.

$\frac{9\sqrt{x}-7}{3\sqrt{x}} \neq \frac{3\sqrt{x}+1}{\sqrt{x}+5}$

$9x+3\sqrt{x}=9x+45\sqrt{x}-7\sqrt{x}-35$

$3\sqrt{x}=38\sqrt{x}-35$ 1 mark

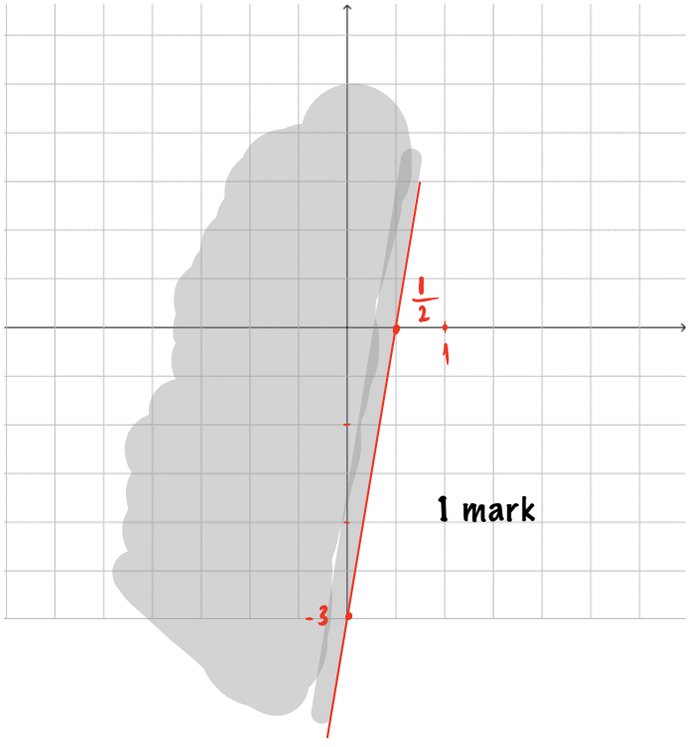
$35\sqrt{x}=35$

$\sqrt{x}=1$

$x=1$ 1 mark

Question 5 2 marks

On the Cartesian plane below, sketch the region described by $4x-\frac{2y}{3}\leq 2$.



1 mark

when $x=0$,

$-\frac{2y}{3}=2$

$y=-3$

$(0,-3)$

when $y=0$

$4x=2$

$x=\frac{1}{2}$

$(\frac{1}{2},0)$

1 mark

2023 Mathematical Methods (Unit 1-2)
Task 1

Paper 2 – Calculator allowed

Number of marks: 15
Writing time: 25 minutes

Name: Marks – Section 1: Section 2:

SECTION 1

Instructions for Section 1

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** for the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.

Question 1

The simultaneous linear equations

$(1-t)x-ty=-1$

$3x-2y=4$

where t is a real constant, has no solution provided

A $t \in \left\{\frac{5}{2}\right\}$

B $t \in R \setminus \left[\frac{2}{5}\right]$

C $t=0$

D $t \in R \setminus \left\{\frac{5}{2}\right\}$

E $t \in \left\{\frac{2}{5}\right\}$

Question 2

The set of numbers $R^{+} \setminus [1,5)$ can be described as:

A $\{x : 1 \leq x < 5\}$

B $\{1,2,3,4\}$

C $(0,1) \cup [5,\infty)$

D $(-\infty,1) \cup [5,\infty)$

E $\{x : 0 < x \leq 1\} \cup \{x : x \geq 5\}$

Question 3

The equation of the line which passes through the point $(4,\sqrt{3})$, makes an angle of 45° with the positive direction of the x-axis.

A $y=4x-\sqrt{3}$

B $y=x+4-\sqrt{3}$

C $y=x-4+\sqrt{3}$

D $y=-x-4+\sqrt{3}$

E $y=4x+\sqrt{3}$

Question 4

The algorithm shown on the right will print the value.

```
Integer a, b, c
Set a = 8, b = 6, c = 4
If (a > b)
a = a + b
Else
b = b - a
End If
If (c > b)
c = c - b
Else
b = c + b
End If
Print a + b + c
```

A 14

B 18

C 24

D 28

E 32

Question 5

For what values of x, $\dfrac{x^2-9}{(x^2-4)(x^3-16x)}$ is undefined?

A $x=0,\pm 2,\pm 3,\pm 4$

B $x=0,\pm 2,\pm 4$

C $x=\pm 2,\pm 4$

D $x=0,+2,+4$

E $x=\pm 3$

SECTION 2

Instructions for Section 2

Answer **all** questions in the spaces provided.

In all questions where a numerical answer is required, an exact value must be given unless otherwise specified.

In questions where more than one mark is available, appropriate working **must** be shown.

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Question 1

A damaged plane is flying at a height of 5000 m and is losing altitude at rate of 80 m per minute.

a. Write a linear equation to model this situation in term of height (h) in meters and time (t) in minutes. 1 mark

$h = 5000 - 80t$ 1 mark

b. If the plane is 1.5 hours from the nearest airport, can the plane make it to the airport before it needs to make a crash landing? 1 mark

$h = 5000 - 80 \times 1.5 \times 60$

$= -2200$ m No 1 mark

c. What is the maximum time to the nearest minute the plane can stay in the air? 1 mark

$t = \frac{5000}{80} = 62.5$ mins → 63 mins 1 mark

Question 2

2 marks

Show that $\left(\frac{1}{1+\frac{2}{a+1}}\right)\left(\frac{a^2+4a-1}{a+1}-2\right)=a-1$

$\frac{1}{\frac{a+1+2}{a+1}} \times \frac{a^2+4a-1-2a-2}{a+1}$

1 mark

$\frac{a+1}{a+3} \times \frac{a^2+2a-3}{a+1}$

$\frac{(a+3)(a-1)}{a+3} = a-1$ 1 mark

Question 3

Let K be a point on the straight line $y = 3x - 2$ such that the length of OK, the line segment from the origin, is a minimum.

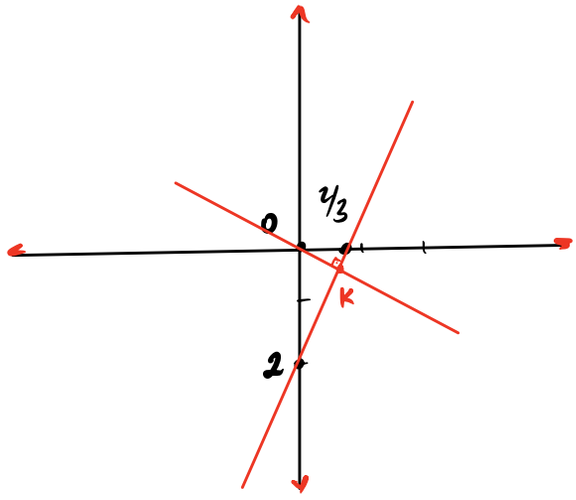
a. Find the equation of OK. 2 marks

$m = 3$

$m_{OK} \cdot m = -1$ 1 mark

$m_{OK} = -\frac{1}{3}$

$y = -\frac{1}{3}x$ 1 mark



b. Find the coordinate of K. 2 marks

$y = -\frac{1}{3}x$

$y = 3x - 2$

1 mark

$-\frac{1}{3}x = 3x - 2$

$-x = 9x - 6$

$10x = 6$

$x = \frac{3}{5}$

$K\left(\frac{3}{5}, -\frac{1}{5}\right)$ 1 mark

c. Find the distance of OK. 1 mark

$d = \sqrt{\left(\frac{3}{5}\right)^2 + \left(\frac{1}{5}\right)^2}$

$= \sqrt{\frac{9+1}{25}} = \frac{\sqrt{10}}{25}$ 1 mark