

# Supervision Instructions

## Mathematics Methods (Unit 1-2) Task #1 March 2022 – 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.



## 2022 Mathematical Methods (Unit 1-2)

### Task 1

Paper 1 – Calculator not allowed

Number of marks: 10

Writing time: 15 minutes

Name:

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  $x \in \mathbb{R} \setminus \{-1, 0\}$ .

$$\frac{(x+1) \times 5}{6x} - \frac{(6x) \times 1}{x+1} = \frac{1}{3x}$$

$$\frac{5x+5-6x}{6x(x+1)} = \frac{2x+2}{6x(x+1)}$$

$$-3x = -3$$

$$x = 1$$

1 mark for correctly expanding numerator & denominator  
1 mark for  $x=1$

#### Question 2

2 marks

Simplify

$$\frac{x^2+8x+12}{3x^2+6x+12} \div \frac{5x^2-20}{3x^3-24}$$

$$\frac{(x+2)(x+6)}{3(x^2+2x+4)} \times \frac{3(x^3-8)}{5(x^2-4)}$$

$$\frac{(x+2)(x+6)}{3(x+2)^2} \times \frac{3(x-2)(x^2+2x+4)}{5(x-2)(x+2)} = \frac{x+6}{5}$$

1 mark for correct factorisation (3 out of 4 correct)  
1 mark for correct simplification. Award consequential mark if simplification done correctly

### Question 3

2 marks

Find the equation of the line which passes through the point  $(6, -10)$ , and is perpendicular to the line  $4y - 3x + 20 = 0$ .

$$4y = 3x - 20$$

$$y = \frac{3}{4}x - 5$$

$$\Rightarrow m = -\frac{4}{3}$$

1 mark

Substitute  $(6, -10)$

$$-10 = -\frac{4}{3}(6) + c$$

$$c = -2$$

$$y = -\frac{4}{3}x - 2 \leftarrow 1 \text{ mark}$$

### Question 4

2 marks

Solve for  $a$ .

$$\frac{\sqrt{a}}{\sqrt{a}-\sqrt{3}} + \frac{\sqrt{a}}{\sqrt{a}+\sqrt{3}} = \frac{7}{2}$$

$$\frac{\sqrt{a}(\sqrt{a}+\sqrt{3}) + \sqrt{a}(\sqrt{a}-\sqrt{3})}{(\sqrt{a}-\sqrt{3})(\sqrt{a}+\sqrt{3})} = \frac{2a}{a-3} = \frac{7}{2}$$

$$4a = 7a - 21$$

$$3a = 21$$

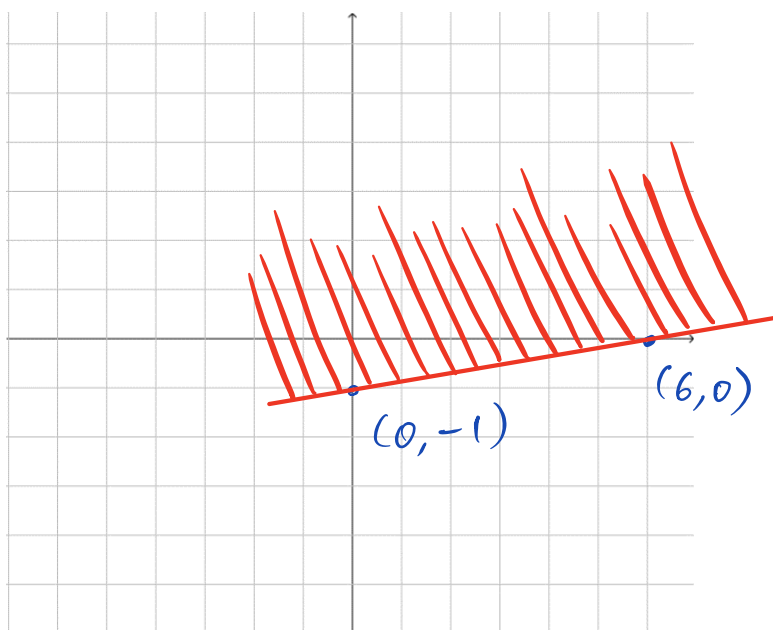
$$a = 7$$

1 mark for rationalising the denominator  
1 mark for correct answer

### Question 5

2 marks

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



1 mark for correct intercepts and solid line. Deduct mark for any mistake.

1 mark for correct shaded area



## 2022 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

A money jar has only 10 cent and 20 cent coins with a total amount of \$11.50. The number of 20 cent coins is five more than two thirds of 20 cent coins. Let  $x$  be the number of 10 cent coins and  $y$  be the number of 20 cent coins. Which of the following is true?

A  $10x + 20y = 11.50$

B  $3y - 2x = 15$

C  $y + \frac{2}{3}x = 5$

D  $x + y = 11.50$

E  $3x - 2y = 5$

#### Question 2

For what values of  $x$ ,  $\frac{x^2 - 4}{(x^2 - 9)(x^3 + 4x^2 - 21x)}$  is undefined?

A  $x = 0, \pm 2, \pm 3, 7$

B  $x = 0, \pm 1, \pm 2, 7$

C  $x = 0, \pm 3, -7$

D  $x = 0, \pm 4, \pm 9 - 21$

E  $x = 0, \pm 3, -21$

### Question 3

The simultaneous linear equations

$$(1-k)x - y = -3$$

$$2x + ky = 7$$

where  $k$  is a real constant, has no solution provided

- A  $k \in \{-2, 1\}$
- B  $k \in R \setminus \{-1, 2\}$
- C  $k = -7$
- D  $k \in R \setminus \{-2, 1\}$
- E  $k \in \{-1, 2\}$

### Question 4

The set of numbers  $R \setminus [-2, 5)$  can be described as:

- A  $\{x : -2 \leq x < 5\}$
- B  $\{-2, -1, 0, 1, 2, 3, 4, 5\}$
- C  $(-\infty, -2] \cup (5, \infty)$
- D  $(-\infty, -2] \cup [5, \infty)$
- E  $\{x : x < -2\} \cup \{x : x \geq 5\}$

### Question 5

The value of the angle to the nearest degree between the line  $5y = 4 - 9x$  and the positive direction of the  $x$ -axis is

- A  $60^\circ$
- B  $61^\circ$
- C  $84^\circ$
- D  $119^\circ$
- E  $120^\circ$

## 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

GreenBud, a small company that manufactures garden shovels, has overhead expenses of \$27000 per year. In addition, it costs \$12 to manufacture each shovel.

- a. Write a rule which determines the total cost,  $C$ , of manufacturing  $x$  shovels per year. 1 mark

$$C = 12x + 27000$$

- b. GreenBud sells each shovel for \$40. What is the minimum number of shovels that must be produced for GreenBud to make a profit each year? 1 mark

$$\text{Revenue} > \text{Cost}$$

$$40x > 12x + 27000$$

$$x > 964.2 \quad \text{Minimum } \boxed{965} \text{ shovels required}$$

### Question 2

2 marks

Show that  $\frac{x^5 - xy^2}{x^3 - yx} + \frac{x^4 - 2yx^2 + y^2}{y - x^2} = 2y$

$$\Rightarrow \frac{x(x^4 - y^2)}{x(x^2 - y)} + \frac{(x^2 - y)^2}{-(x^2 - y)}$$

$$\Rightarrow \frac{(x^2 - y)(x^2 + y)}{(x^2 - y)} - (x^2 - y)$$

$$\Rightarrow x^2 + y - x^2 + y$$

$$\Rightarrow 2y$$

1 mark for correct factorisation.  
Deduct mark for any mistake.

1 mark for correct simplification.  
Consequential mark applies

### Question 3

A triangle ABC drawn on a Cartesian plane where AB is perpendicular to BC. The vertex A touches the y-axis at  $y=1$  and the vertex B touches the x-axis at  $x=7$ .

- a. Find the equation of AB.

2 marks

$$A(0,1) \text{ and } B(7,0)$$

$$M_{AB} = \frac{0-1}{7-0} = -\frac{1}{7} \rightarrow 1 \text{ mark}$$

$$y = -\frac{1}{7}x + 1 \rightarrow 1 \text{ mark}$$

- b. Find the equation of BC.

2 marks

$$M_{BC} = 7 \rightarrow 1 \text{ mark}$$

Substitute (7,0)

$$0 = 7(7) + c$$

$$c = -49$$

$$y = 7x - 49 \rightarrow 1 \text{ mark}$$

- c. Vertex C intersects with the line  $y+2x=23$ . Find the equation of AC.

2 marks

$y = -2x + 23$  also intersects line BC

$$7x - 49 = -2x + 23$$

$$9x = 72$$

$$x = 8$$

$$y = -2(8) + 23$$

$$y = 7$$

$$M_{AC} = \frac{7-1}{8-0} = \frac{6}{8} = \frac{3}{4}$$

$$y - 1 = \frac{3}{4}(x - 0)$$

$$y = \frac{3}{4}x + 1 \rightarrow 1 \text{ mark}$$

Vertex C(8,7)  $\rightarrow 1 \text{ mark}$