Name:



**HERITAGE COLLEGE**

**Semester 1 Examinations**

**2024**

**Year 9 Mathematics (Formative)**

**Time: 2 hours**

**Instructions**

1. You will have 5 minutes reading time during which time you may make notes on scribble paper only.
2. If you require more paper to complete answers, raise your hand and a supervisor will help you.
3. You must remain in the exam room for the full duration of the exam.

Use the laws of indices to simplify the following (leave in fraction form):

|  |  |  |  |
| --- | --- | --- | --- |
| 1. $x^{3}×x^{10}$
 | 1. $\frac{x^{12}}{x^{3}}$
 | 1. $10xy^{3}×4y^{4}$
 | 1. $\frac{12x^{5}y^{4}}{3x^{2}y^{3}}$
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 (4 marks)

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| 1. $10x^{0}-1$
 | 1. $\left(\frac{2x}{y^{2}}\right)^{3}$
 | 1. $3^{-4}$
 | 1. $\left(\frac{2}{7}\right)^{-2}$
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 (4 marks)

Write the following as ordinary decimal numbers:

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| 1. The length of the earth’s equator is approximately $4.01×10^{4}$ km
 | 1. The wavelength of blue light is $4.75×10^{-7}$ m
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 (2 marks)

Write the following using scientific notation:

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| 1. The probability of winning the lottery on Monday night is 0.000 000 141 62
 | 1. The distance from the Sun to Mars is about 249 000 000 km
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 (2 marks)

Expand and simplify the following expressions using the appropriate rule:

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| 1. $3x\left(x-5\right)$
 | 1. $\left(x-5\right)\left(x-5\right)$
 |

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 (4 marks)

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| 1. $\left(2x+7\right)\left(2x-7\right)$
 | 1. $(3x+4)(x-2)$
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 (4 marks)

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| 1. Find the perimeter P, of:

 HINT: Add up all the side lengths | 1. Find the shaded area A, of:

 HINT: $Area of a rectangle=Length×Width$ |

(*x*+8) cm

(*x*+2) cm

*x* cm

3*x* cm

(2*x*+12) cm

(*x*+1) cm

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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 (4 marks)

Fully factorise the following

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| --- | --- |
| 1. $6x^{2}-2x$
 | 1. $2p\left(a+7\right)+3q(a+7)$
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 (4 marks)

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| --- | --- |
| 1. $cd-5d+3c-15$
 | 1. $x^{2}+7x+4x+28$
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 (4 marks)

Solve the following linear equations:

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| --- | --- |
| 1. $\frac{x}{3}+4=8$
 | 1. $\frac{5x-3}{2}=6$
 |
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 (4 marks)

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| --- | --- |
| 1. $9x+5=5x-3$
 | 1. $\frac{3x-2}{7}=\frac{x+6}{4}$
 |
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 (4 marks)

The sum of three consecutive whole numbers is 66. What are the numbers? (Show a full algebraic solution.)

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 (4 marks)

Calculate the gradient of the following lines:

|  |  |
| --- | --- |
|  | 1. The line joining the points (1, 8) and (4, 2)
 |

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 (2 marks)

1. Sketching Linear Graphs (6 marks)

Sketch the graphs of the following lines: (show all reasoning)

|  |  |
| --- | --- |
| 1. $y=-5$
 | 1. $y=\frac{5}{2}x-4$
 |

|  |  |
| --- | --- |
| 1. $4x+3y=12$
 | 1. $x=2$
 |

1. Parallel and Perpendicular Lines (5 marks)

Two lines are given by and $y=\frac{k}{5}x-6$ ➀ and $4x-3y-2=0$ ➁.

|  |  |
| --- | --- |
| 1. Write down the gradient of the line represented by equation ➀
 | 1. Rearrange equation ➁ to find its gradient
 |

|  |  |
| --- | --- |
| 1. What is the connection between the gradients of parallel lines
 | 1. Find the value of $k$ such that the lines are parallel
 |

1. Using Linear Relationships (5 marks)

An electrician charges a fixed fee plus an hourly rate. A job that takes 2 hours to complete costs $280 and a job that takes 3.5 hours to complete costs $437.50

|  |
| --- |
| 1. Show that the linear model to express the charge, $$C$, for $t$ hours of work is given by $C=105t+70$
 |

|  |
| --- |
| 1. Find the amount the electrician earns if a job takes 8 hours
 |

|  |
| --- |
| 1. Find the time taken to complete the job if the charge was $306.25
 |

1. Using the Null Factor Law (4 marks)

Solve the following quadratic equations using factorising and the null factor law:

|  |  |
| --- | --- |
| 1. $\left(x+7\right)\left(x-10\right)=0$
 | 1. $2x^{2}-6x=0$
 |

1. Solving Quadratic Equations (4 marks)

Solve the following quadratic equations using factorising and the null factor law:

|  |  |
| --- | --- |
| 1. $\left(x+8\right)\left(x-2\right)=6x$
 | 1. $x^{2}-20x+36=-64$
 |

1. Problem Solving with Quadratic Equations (6 marks)
2. Use the FOIL rule to show that $\left(x-8\right)\left(x+13\right)=x^{2}+5x-104$
3. A rectangular plot has length 5 m more than its width. If its area is 104 m², find the dimensions of the plot. HINT: Part (a) should help you when it comes to factorising. (Show a full algebraic solution)
4. Non-linear relationships (7 marks)

Tennis player Kezia tosses the ball into the air before she serves it. The ball’s height above ground $t$ seconds after it is tossed is given by the function $H\left(t\right)=-5t^{2}+6t+2$ metres.

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| --- |
| 1. Complete the table of values to plot the tennis ball’s progress through the air.
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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| $$t$$ | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 |
| $$H$$ |  | 2.55 |  | 3.35 |  | 3.75 |  | 3.75 |  | 3.35 |  | 2.55 |  | 1.35 |  | -0.25 |

-1

0

1

2

3

4

-0.1

0

0.1

0.2

0.3

0.4

0.5

0.6

0.7

0.8

0.9

1.0

1.1

1.2

1.3

1.4

1.5

1.6

|  |  |  |
| --- | --- | --- |
| 1. How high was the ball when it was released?
 | 1. When did the tennis ball reach its maximum height?
 | 1. What was the maximum height reached by the tennis ball?
 |

|  |  |
| --- | --- |
| 1. Kezia hits the ball when it is 3 m above the ground, and on its way down. How long after Kezia throws the ball up does she hit it?
 | 1. If Kezia missed the ball, estimate when it would hit the ground.
 |