Grade 12
Pre-Calculus Mathematics
Achievement Test

Booklet 2

June 2019

Manitoba

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Booklet 2. June 2019

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After the administration of this test, print copies of this resource will be available for purchase from the Manitoba Learning Resource Centre. Order online at www.manitobalrc.ca.

This resource will also be available on the Manitoba Education and Training website at www.edu.gov.mb.ca/k12/assess/archives/index.html.

Websites are subject to change without notice.

Disponible en français.

While the department is committed to making its publications as accessible as possible, some parts of this document are not fully accessible at this time.

Available in alternate formats upon request.

Grade 12 Pre-Calculus Mathematics Achievement Test

DESCRIPTION

Time Required to Complete the Test: 3 hours

Additional Time Allowed: 30 minutes

Numbers and Marks by Question Type

	Selected Response	Constructed Response	Marks
Booklet 1*	—	17	34
Booklet 2	9	23	56
Total	9	40	**90**

* The first 4 questions with the symbol  in *Booklet 1* require a scientific calculator. You will have access to your calculator for the first 45 minutes of the test.

Note that diagrams and graphs provided in the test booklets may not be drawn to scale.

DIRECTIONS

Selected Response Questions

- Calculators are **not** allowed for this part of the test.
- You may use the spaces beside each question for rough work.
- Provide only one answer per question.
- There is no penalty for guessing.
- Record your answers on the sheet provided.

Constructed Response Questions

- Calculators are **not** allowed for this part of the test.
- For full marks, your answer must show all pertinent diagrams, calculations, and explanations.
- Your solutions should be neat, clear, and well organized.
- Write each solution in the space provided.

Electronic communication between students through phones, email, or file sharing during the test is strictly prohibited. Please turn off your cell phone and all other such devices.

No marks will be awarded for work done on this page.

Question 18 — 1 mark

The range of $y = f(x)$ is $-6 \le y \le 12$. The range of the transformed function $y = af(x)$ is $-2 \le y \le 4$. Identify the value of a.

a) -3

b) $-\frac{1}{3}$

c) $\frac{1}{3}$

d) 3

Question 19 — 1 mark

Identify the expression which is equivalent to $3\log y - \frac{1}{2}\log x + \log z$.

a) $\log\left(\frac{y^3}{\sqrt{xz}}\right)$

b) $\log\left(\frac{y^3 z}{\sqrt{x}}\right)$

c) $\log\left(\frac{y^3}{x^2 z}\right)$

d) $\log\left(\frac{y^3 z}{x^2}\right)$

Question 20 — 1 mark

Identify the measure of the angle $-\frac{2\pi}{9}$ in degrees.

a) $-400°$

b) $-40°$

c) $40°$

d) $320°$

Question 21 — 1 mark

If $y = f(x)$ has a domain of $[2,5]$ and a range of $[6,10]$, identify the domain of $y = f^{-1}(x)$.

a) $\left[\frac{1}{2}, \frac{1}{5}\right]$

b) $[-5,-2]$

c) $[-10,-6]$

d) $[6,10]$

Question 22 — 1 mark

Identify which of the following is a polynomial function.

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

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

c) $p(x) = 3x^{-4} + x^2 - 6$

d) $p(x) = 2^x + 3$

Question 23 — 1 mark

Identify the total number of terms in the expansion of $(x-y)^9$.

a) 8

b) 9

c) 10

d) 11

Question 24 — 1 mark

Identify the exact value of $2\cos^2(15°) - 1$.

a) 1

b) $\frac{1}{2}$

c) $\frac{\sqrt{3}}{2}$

d) $\sqrt{3}$

Question 25 — 1 mark

The zeros of the function $y = f(x)$ are $x = -2$ and $x = 3$. Identify the zeros of the function $g(x) = 2f(x - 4)$.

a) $x = -6$ and $x = -1$

b) $x = 2$ and $x = 7$

c) $x = -4$ and $x = 6$

d) $x = 0$ and $x = 10$

Question 26 — 1 mark

Identify the value of $\log_4\left(\frac{1}{4}\right)$.

a) -16

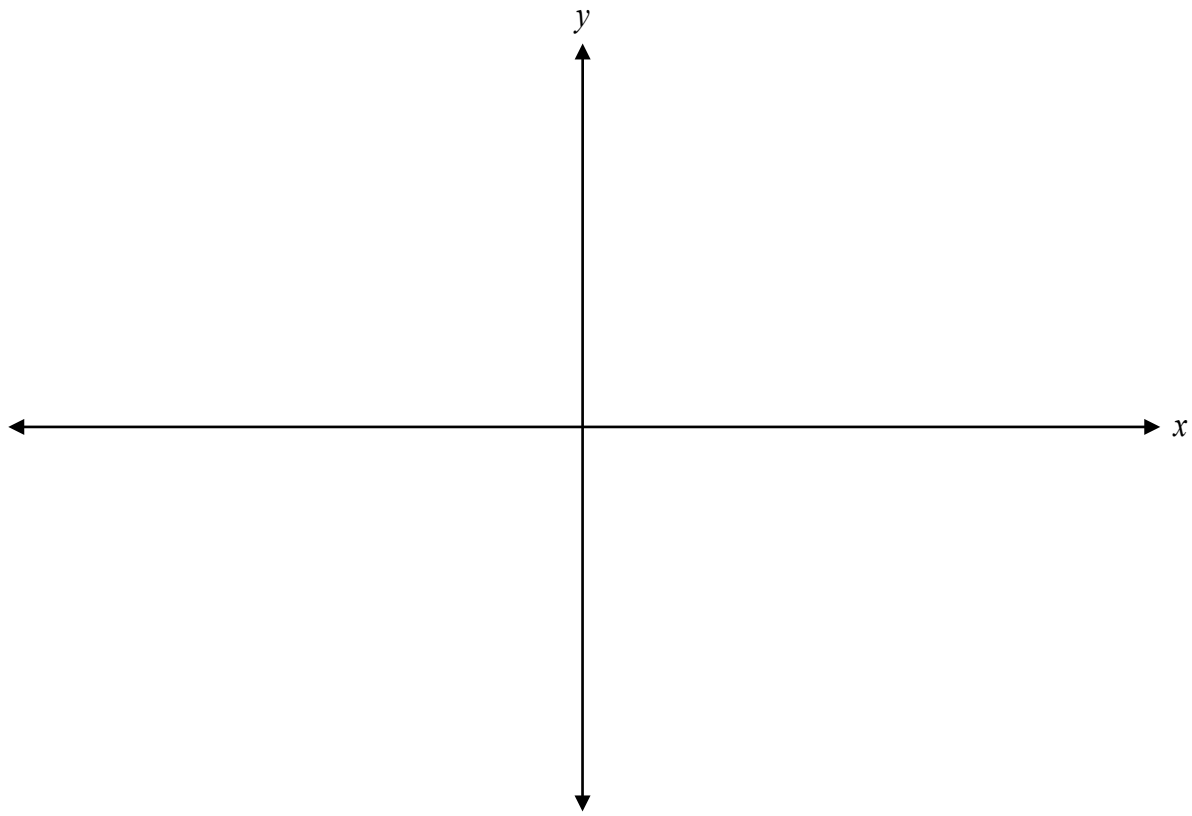
b) -1

c) 1

d) 16

Question 27 — 4 marks — 119

Sketch the graph of at least one period of the function $y = -\cos\left(x + \frac{\pi}{4}\right) + 3$.

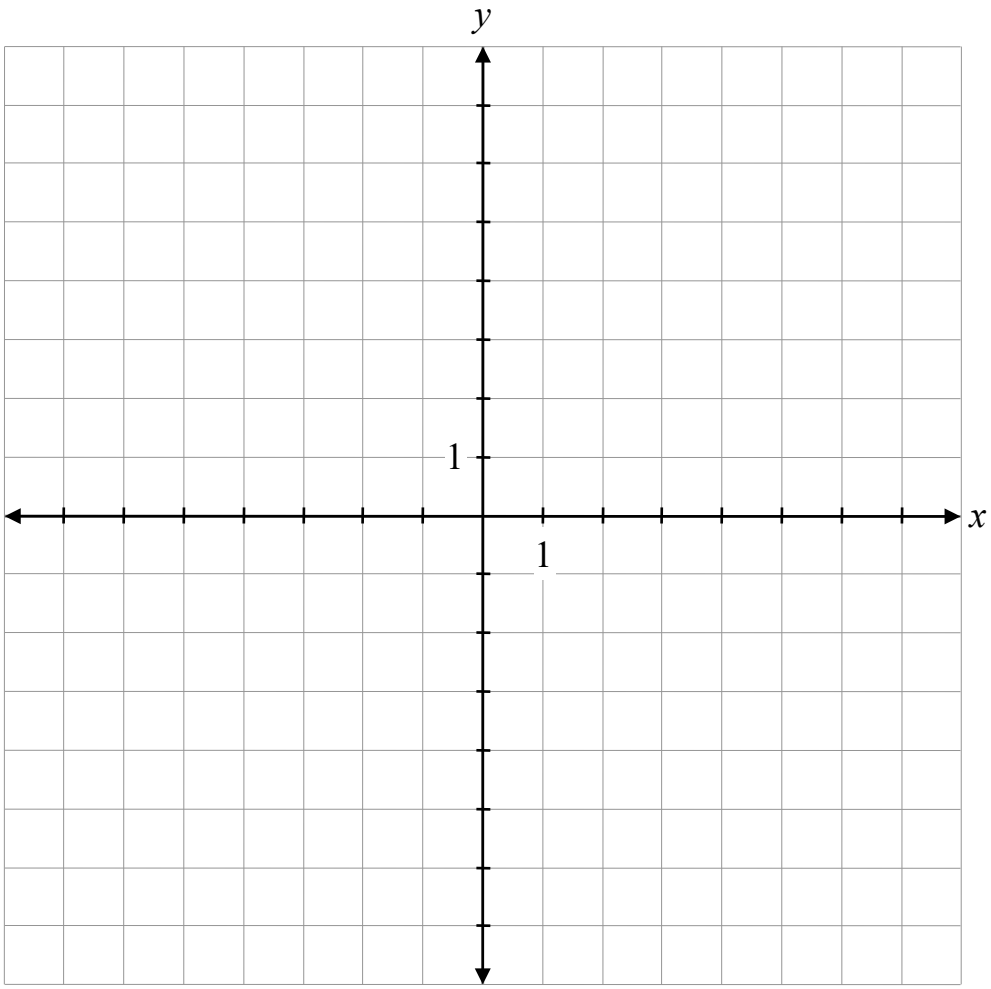


Question 28 — 1 mark — 120

Justify that $(x-5)$ is not a possible factor of the function $P(x) = x^3 - 3x^2 - 4x + 12$.

Question 29 — 4 marks — 121

Sketch the graph of $f(x) = \dfrac{6}{(x+2)(x-3)}$ and state the y-intercept.



y-intercept: _____

Question 30 — 2 marks — 122

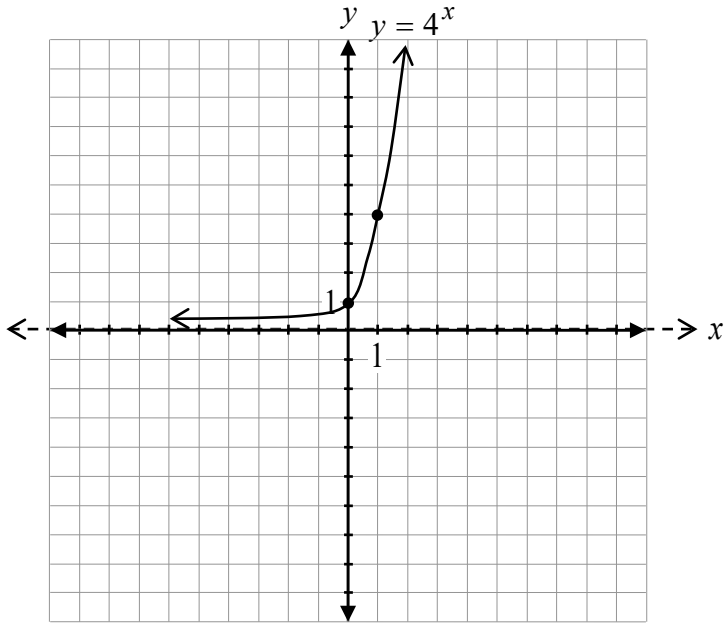
Determine how many 3-digit odd numbers less than 300 are possible using the digits 1, 2, 3, 4, 5, 6 if repetition is not allowed.

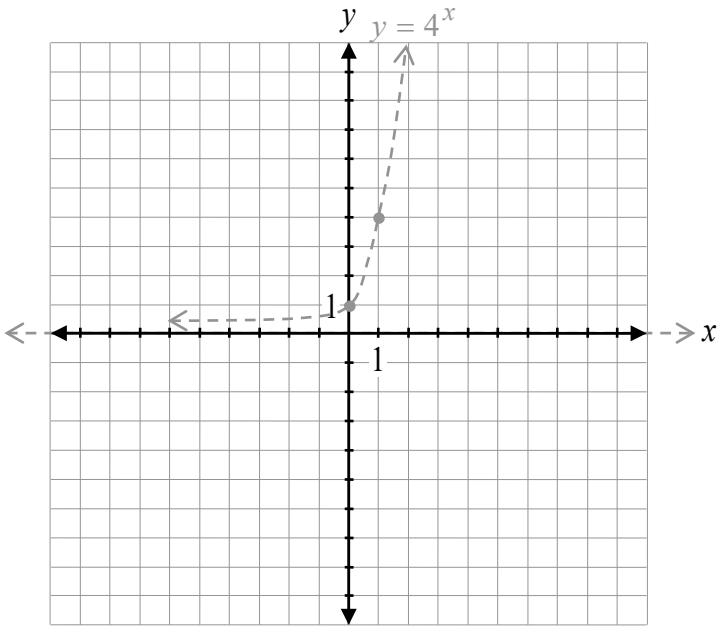
Question 31 — 3 marks — 123

Given that $\cos\alpha = -\frac{5}{13}$ and $\sin\beta = \frac{2}{3}$, where α and β terminate in the same quadrant, determine the exact value of $\cos(\alpha - \beta)$.

Question 32 — 3 marks — 124

Given the graph of $y = 4^x$, sketch the graph of $y = 2(4)^{x-3} + 1$.





The graph of $f(x)$ has already been drawn for your reference.

No marks will be awarded for the graph of $f(x)$.

Question 33 — 1 mark — 125

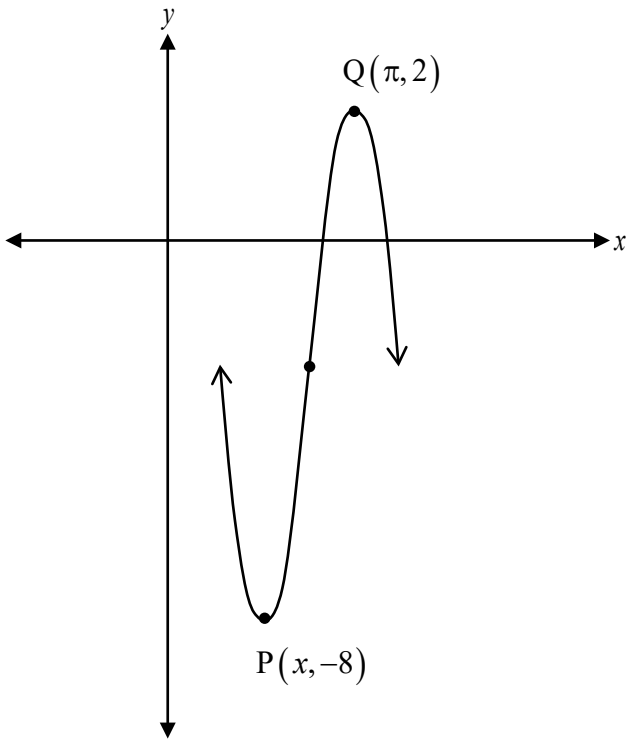
Determine the coterminal angle of $\frac{\pi}{5}$ over the interval $[-2\pi, 0]$.

Question 34 — 1 mark — 126

State the domain of the graph of $y = \log(x - 4) - 8$.

Question 35 — 1 mark — 127

Given the graph of $y = 5\sin\left[2\left(x + \frac{\pi}{4}\right)\right] - 3,$ determine the exact value of the x-coordinate in the point P.



Question 36 — 2 marks — 128

Verify that the following equation is true for $x = \frac{5\pi}{6}$.

$$\frac{\cos x}{1 - \sin x} = \frac{1 + \sin x}{\cos x}$$

Left-Hand Side	Right-Hand Side

Question 37 — 2 marks — 129

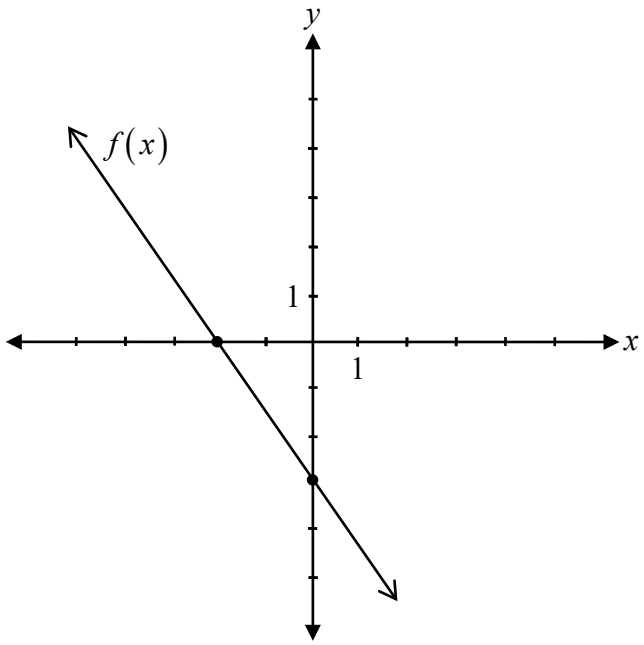
Given that $(x+1)$ is one of the factors of $P(x) = x^3 - x^2 + kx - 8,$ determine the value of k.

Question 38 — 1 mark — 130

Given the function $f(x) = \sqrt{x},$ describe how to use transformations to determine the domain of the function $g(x) = f(x+2)+1.$

Question 39 — 1 mark — 131

Given the graph of $y = f(x)$, state the equation of the vertical asymptote of $y = \dfrac{1}{f(x)}$.



Question 40 — 2 marks — 132

Solve, algebraically.

$$16^{x} = 64^{2x-1}$$

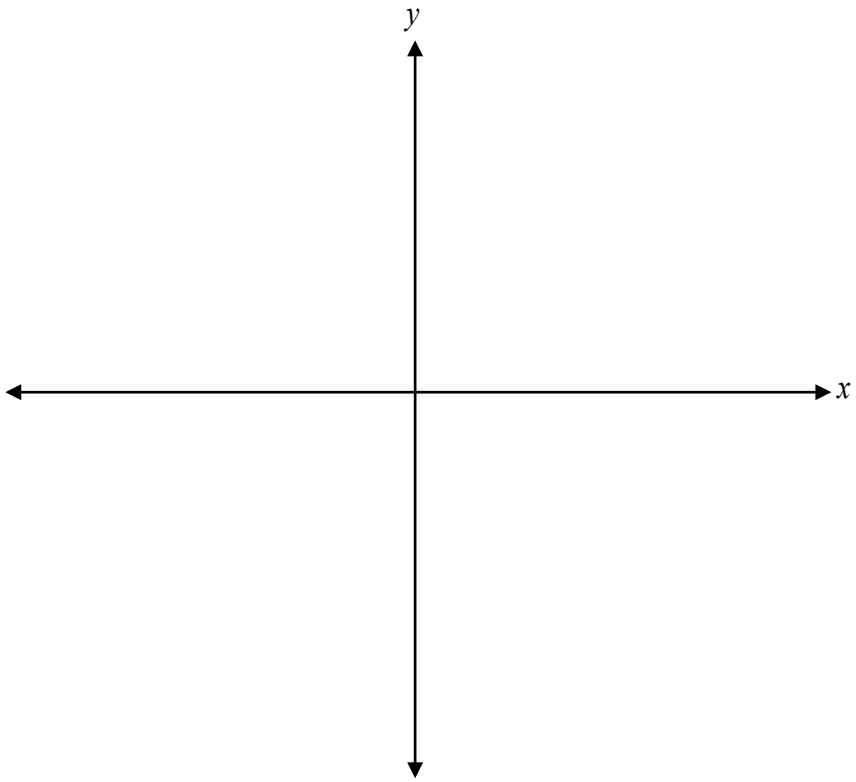
Question 41 — 2 marks — 133

Given one of the factors of $P(x) = x^3 + 2x^2 - 5x - 6$ is $(x + 3)$, express $P(x)$ in completely factored form.

$P(x) =$ _____

Question 42 — 3 marks — 134

Sketch the graph of $p(x) = 3(x+1)^2(x-2)^2$.



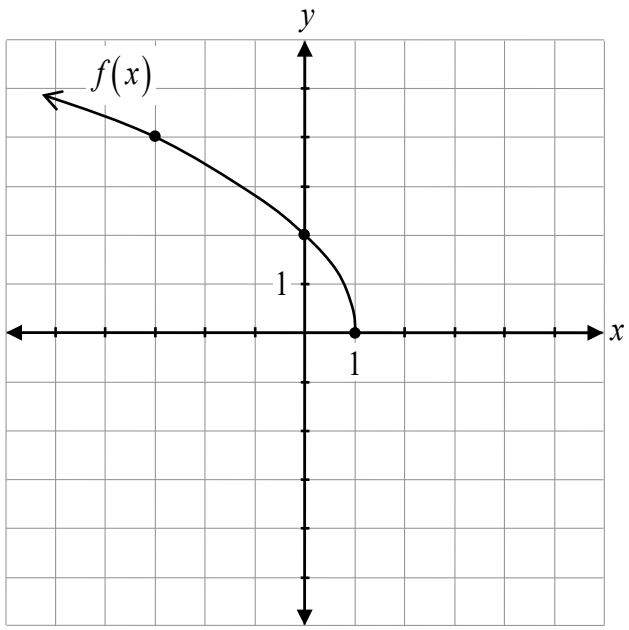
Question 43 — 2 marks — 135

Given that $f(x) = x^2 - 4$ and $g(x) = \sqrt{x}$, determine $f(g(x))$ and state its domain.

$f(g(x)) =$ _____

Question 44 — 3 marks — 136

Determine a possible equation of the function $f(x)$.



$f(x) =$ _____

Question 45 — 1 mark — 137

Explain why the graph of $y = \log_2 x$ does not have a y-intercept.

Question 46 — 3 marks — 138

Evaluate.

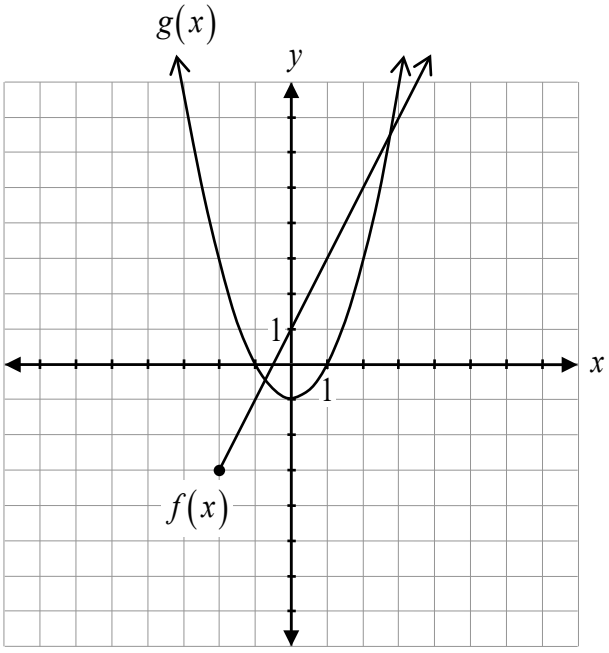
$$\sin^2\left(-\frac{\pi}{3}\right)+\cos\left(\frac{17\pi}{6}\right)\sec\left(\frac{\pi}{6}\right)$$

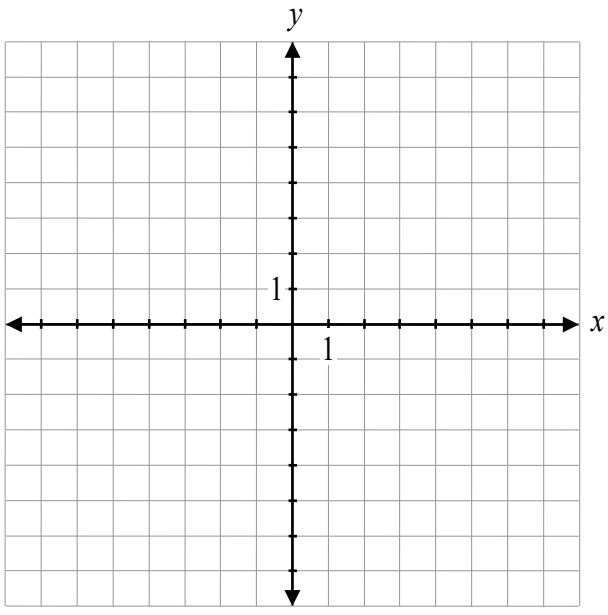
Question 47 — 1 mark — 139

Determine the coordinates of the point of discontinuity (hole) on the graph of $y = \dfrac{x^2 - 3x}{x}$.

Question 48 — 2 marks — 140

Given the graphs of $f(x)$ and $g(x)$, sketch the graph of $h(x) = f(x) + g(x)$.





Question 49 — 2 marks — 141

Given that $\csc\theta = -\frac{4}{\sqrt{7}}$ and $\cos\theta > 0,$ determine the exact value of $\tan\theta.$

No marks will be awarded for work done on this page.