Grade 12
Pre-Calculus Mathematics
Achievement Test

Booklet 2

June 2017

Manitoba

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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.

Instructions

Selected Response Questions

- There are 10 questions worth a total of 11 marks.
- 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

- There are 22 questions worth a total of 46 marks.
- 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.

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

Question 18 — 1 mark

If $P(3,5)$ is a point on the graph of $y = f(x)$, identify the corresponding point on the graph of $y = f(x-1)+7$.

a) $(2,12)$

b) $(4,-2)$

c) $(2,-2)$

d) $(4,12)$

Question 19 — 1 mark

Identify how the graph of $y = 3^x$ is transformed to the graph of $y = 3^{-x}$.

a) reflected over the *x*-axis

b) reflected over the *y*-axis

c) reflected over both the *x*-axis and the *y*-axis

d) reflected over the line $y = x$

Question 20 — 1 mark

Identify the equation $\log_a b = c$ in exponential form.

a) $b^c = a$

b) $a^c = b$

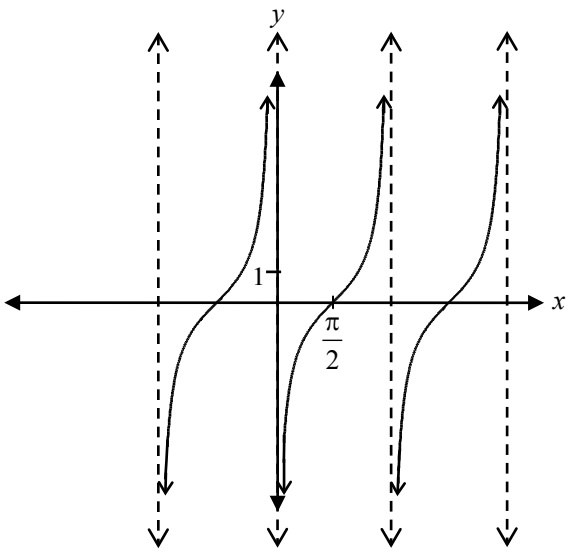
c) $a^b = c$

d) $c^a = b$

Question 21 — 1 mark

Identify the graph of $y = \tan x$.

a)



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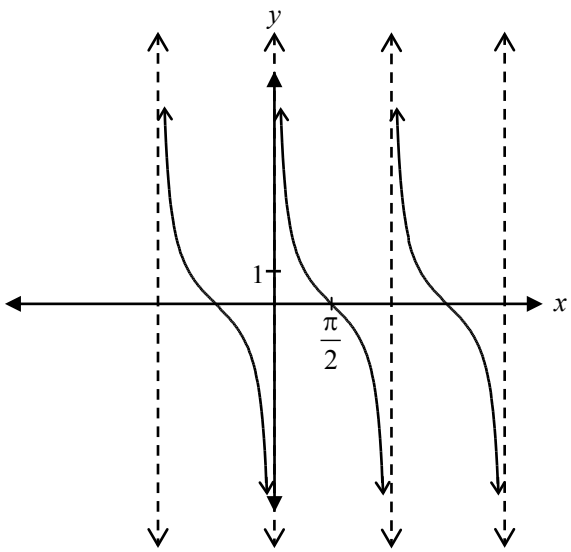

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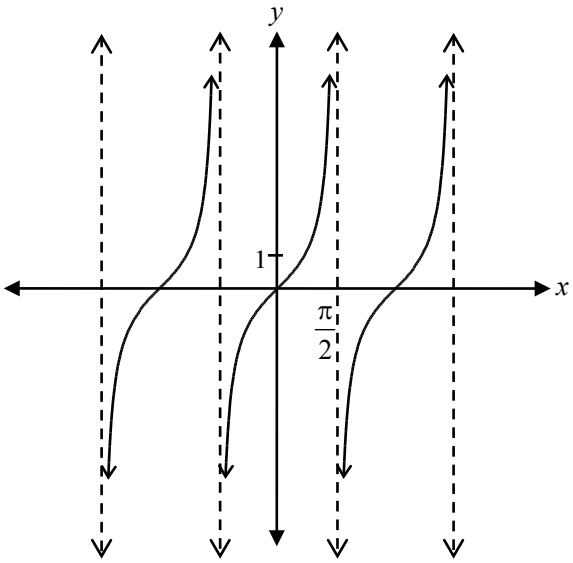

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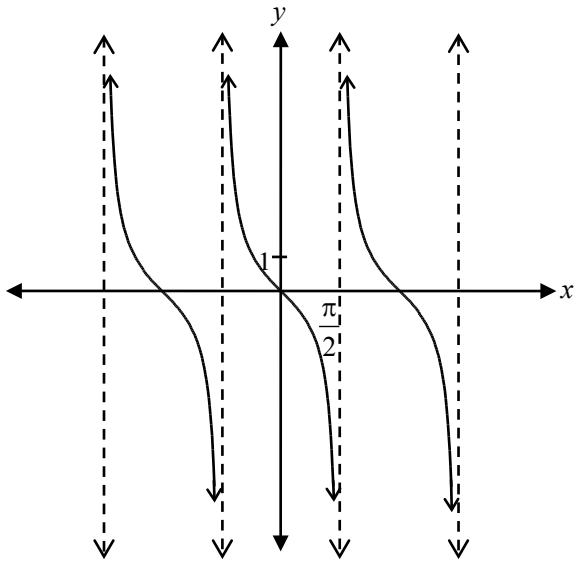
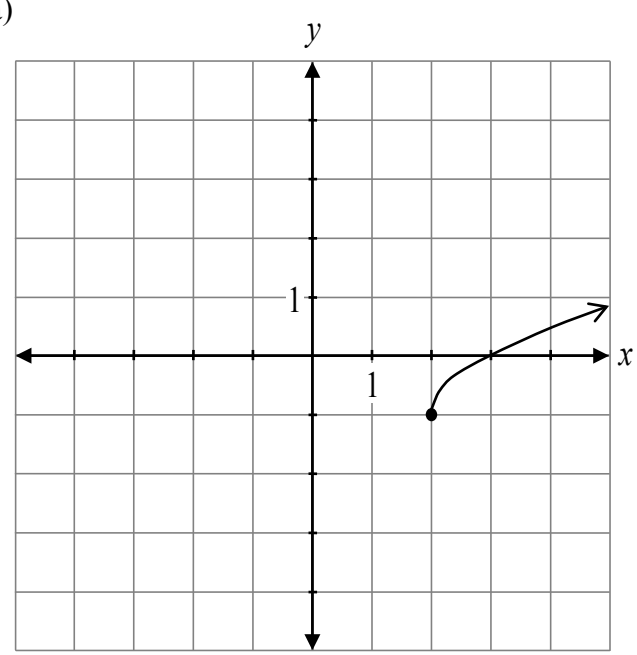


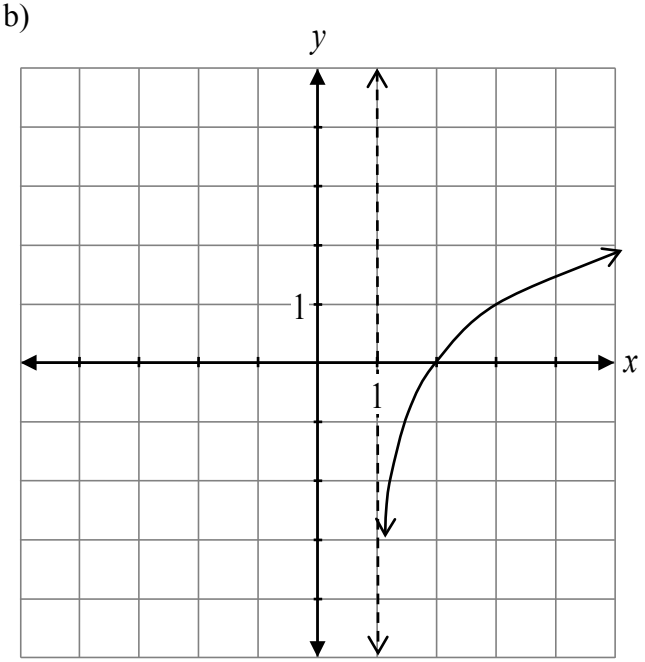
Question 22 — 1 mark

Identify which of the following graphs represents a logarithmic function.

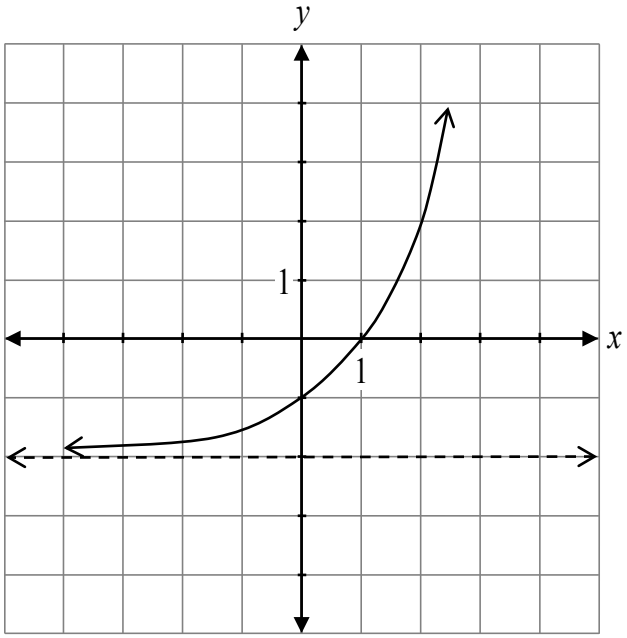
a)



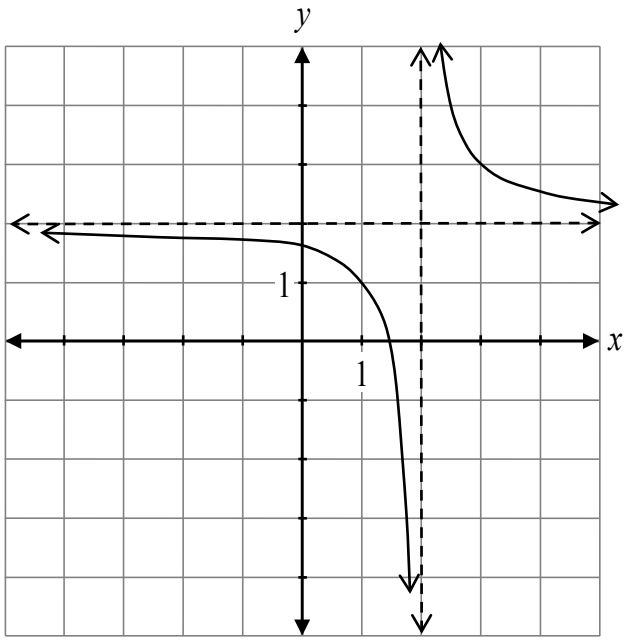
b)



c)



d)



Question 23 — 1 mark

If the volume of a box is represented by $V(x) = (x+4)(x+2)(x-1)$, identify a possible value of x.

a) -4

b) -1

c) 1

d) 4

Question 24 — 1 mark

Identify a coterminal angle for $\theta = -\frac{\pi}{3}$.

a) $\frac{\pi}{3}$

b) $\frac{4\pi}{3}$

c) $\frac{7\pi}{3}$

d) $\frac{11\pi}{3}$

Question 25 — 1 mark

Identify the value of n in the equation ${}_nC_3 = {}_nC_6$.

a) 3

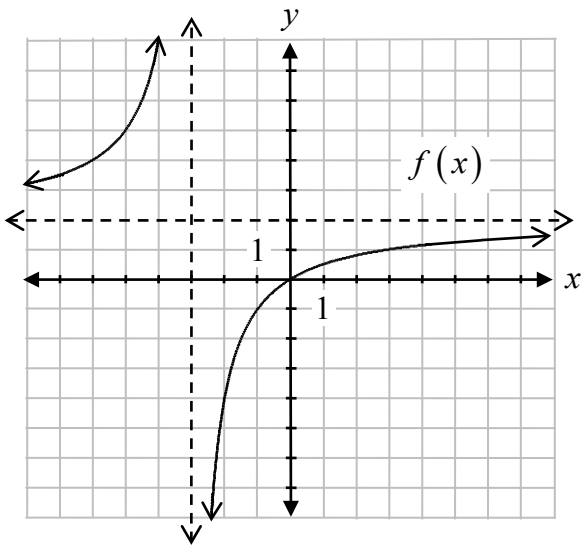
b) 6

c) 9

d) 18

Question 26 — 1 mark

Identify the equation of the function, $f(x)$, for the following graph.



a) $f(x) = \dfrac{2x}{x+3}$

b) $f(x) = \dfrac{2}{x+3}$

c) $f(x) = \dfrac{2x^2}{x(x+3)}$

d) $f(x) = \dfrac{3x^2}{x(x+2)}$

Question 27 — 2 marks

Match the following radical functions with their graphs.

Place the appropriate letter in this column.

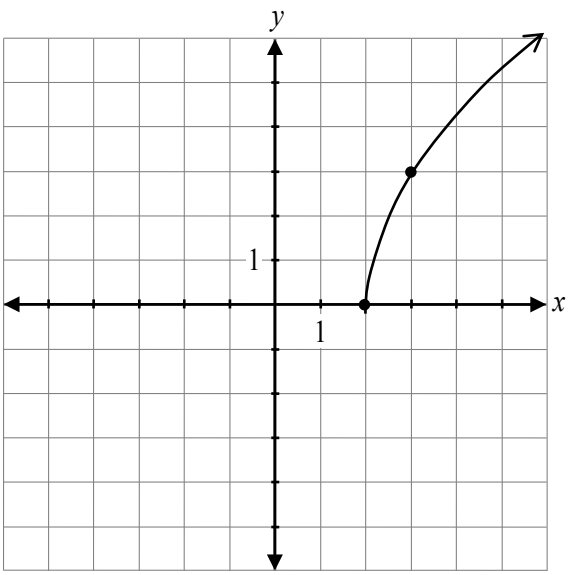
$f(x) = 2\sqrt{-(x+3)}$ _____

$g(x) = -2\sqrt{(x+3)}$ _____

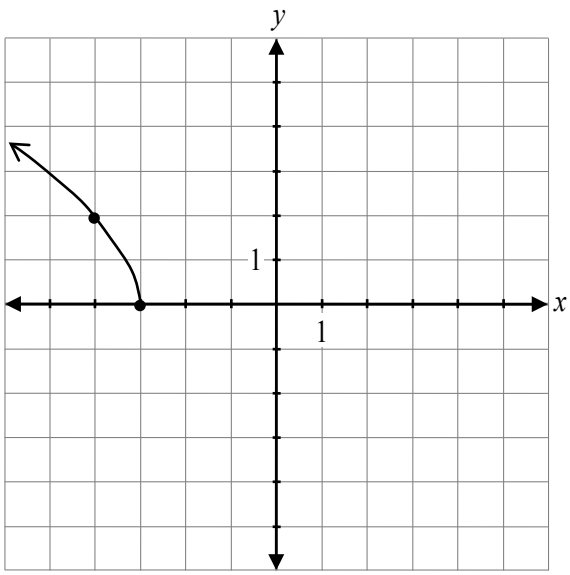
$h(x) = 3\sqrt{(x-2)}$ _____

$k(x) = \sqrt{3(x-2)}$ _____

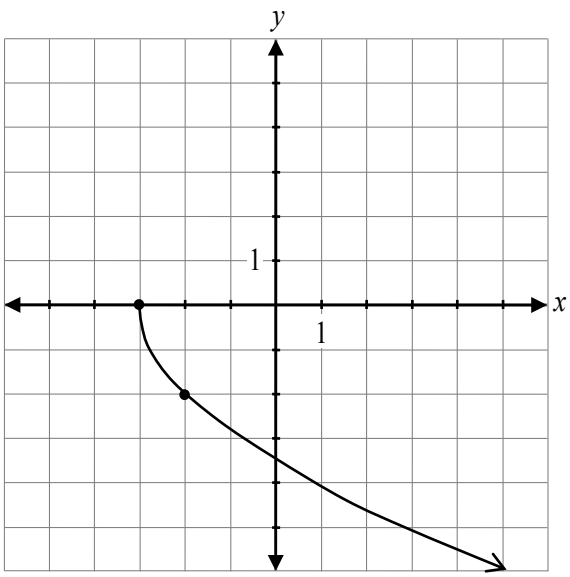
A)



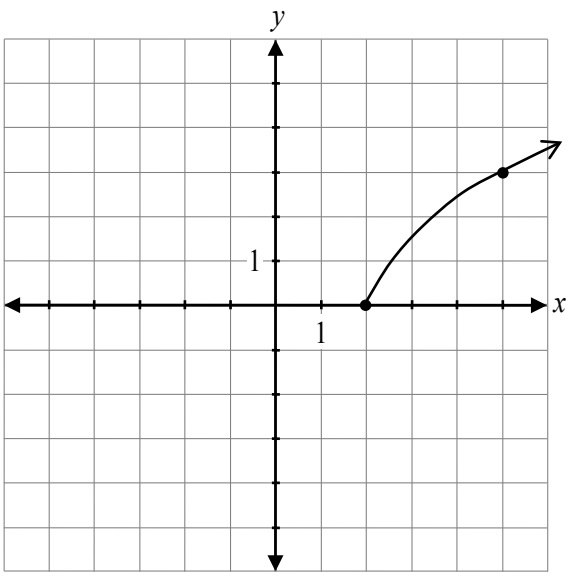
B)



C)



D)



Question 28 — 3 marks — 119

Express $p(x) = x^3 - 2x^2 - 4x + 8$ as a product of factors.

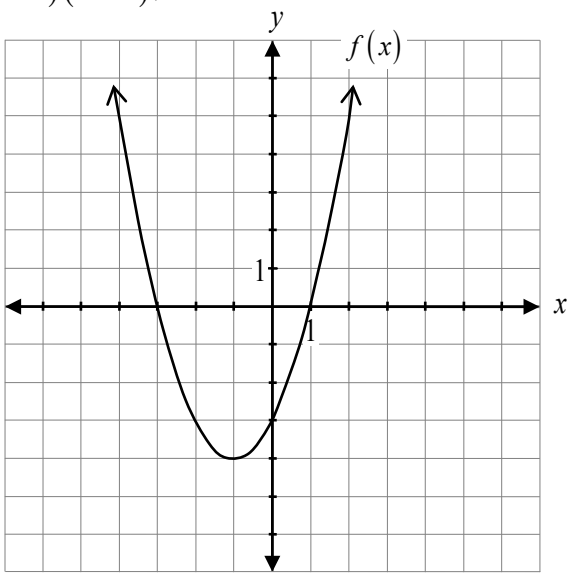
$p(x) =$ _____

Question 29

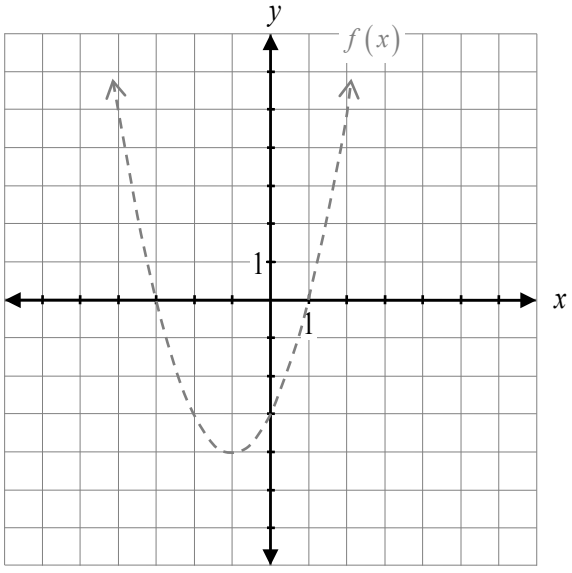
a) 3 marks b) 1 mark

120
121

Given the graph of $f(x) = (x+3)(x-1)$,



a) sketch the graph of $g(x) = \dfrac{1}{f(x)}$.



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

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

b) describe how to sketch the graph of $h(x) = |f(x)|$.

Question 30 — 1 mark — 122

Describe how the value of m in the equation $y = \log_3 (x - m),\ m \in \mathbb{R}$, affects the asymptote on the graph of $y = \log_3 x$.

Question 31 — 2 marks — 123

Solve algebraically.

$$25^x = \left(\frac{1}{5}\right)^{-3x+1}$$

Question 32 — 4 marks — 124

Solve $\cos 2\theta = 0$, where $\theta \in \mathbb{R}$.

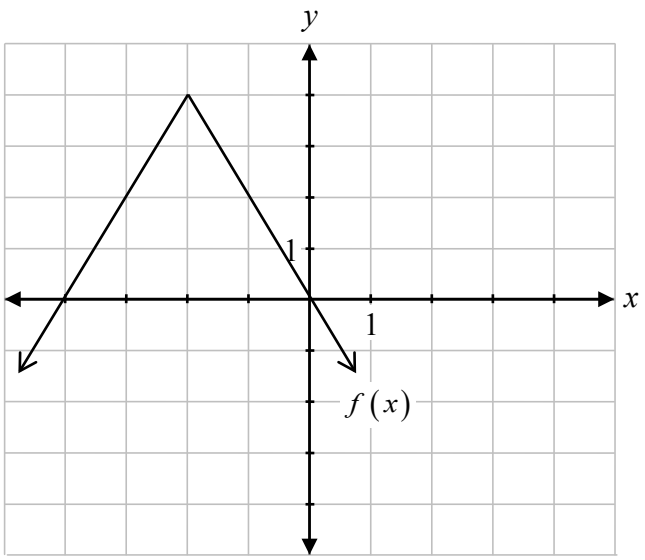
Question 33 — 1 mark — 125

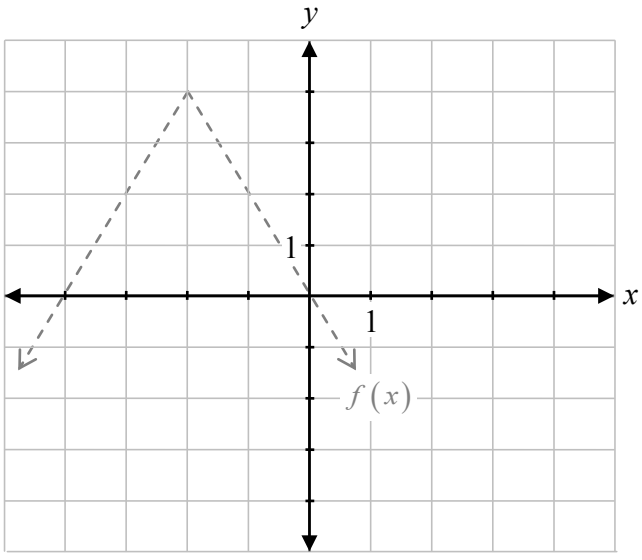
Describe a difference between the graphs of $y = f(x)$ and $y = g(x)$.

$$f(x) = -2(x+1)^2(x+3)$$
$$g(x) = 2(x+1)^2(x+3)$$

Question 34 — 2 marks — 126

Given the graph of $y = f(x)$, sketch the graph of $\sqrt{f(x)}$.





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

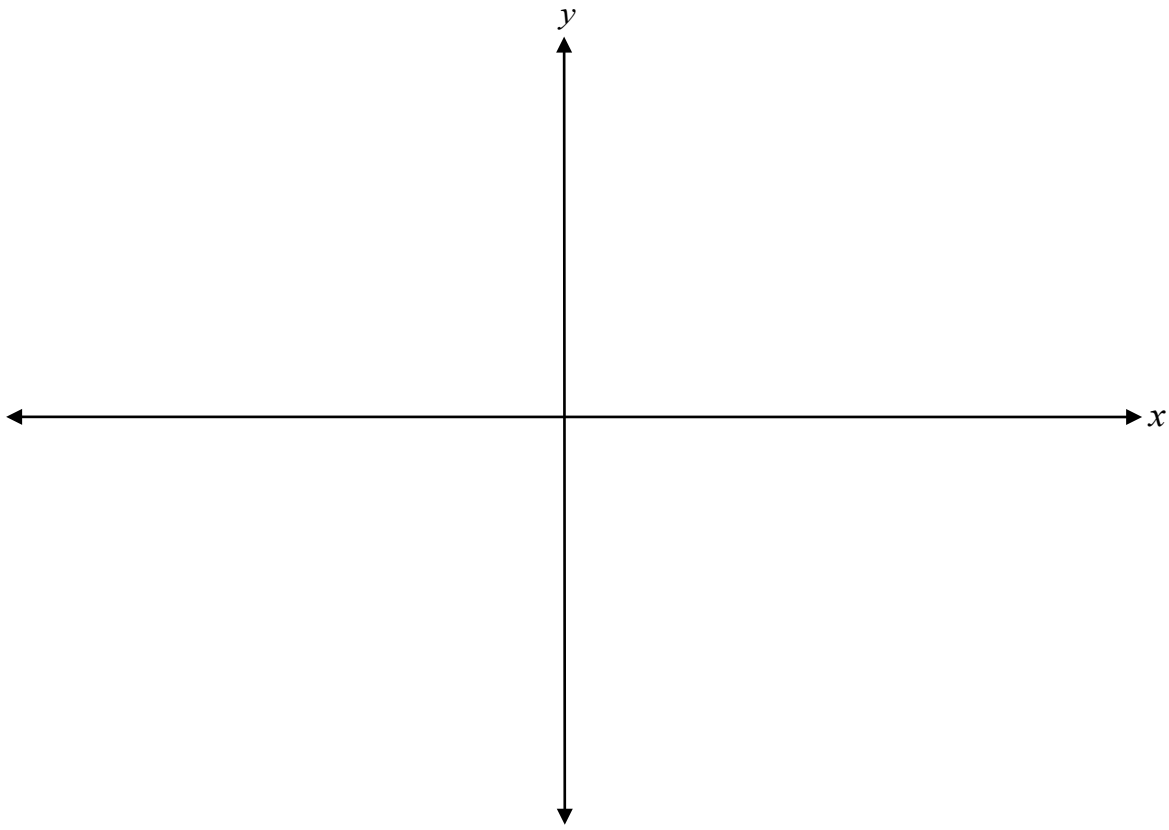
No marks will be awarded for the graph of $f(x)$.

Question 35 — 1 mark — 127

Describe the relationship between the zeros of the function $f(x) = (2x-1)(x+3)^2$, the roots of the equation $(2x-1)(x+3)^2 = 0$, and the x-intercepts of the graph of $y = f(x)$.

Question 36 — 3 marks — 128

Sketch a graph of at least one period of the function $f(x) = \cos\left[\frac{1}{2}\left(x + \frac{\pi}{2}\right)\right] - 3$.



Question 37 — 1 mark — 129

Verify that $\theta = \frac{4\pi}{3}$ is a solution of the equation $4\cos^2\theta - 1 = 0.$

Question 38 — 1 mark — 130

Describe how to determine the equation of the horizontal asymptote of a rational function when the degree of the polynomial in the numerator and the degree of the polynomial in the denominator are equal.

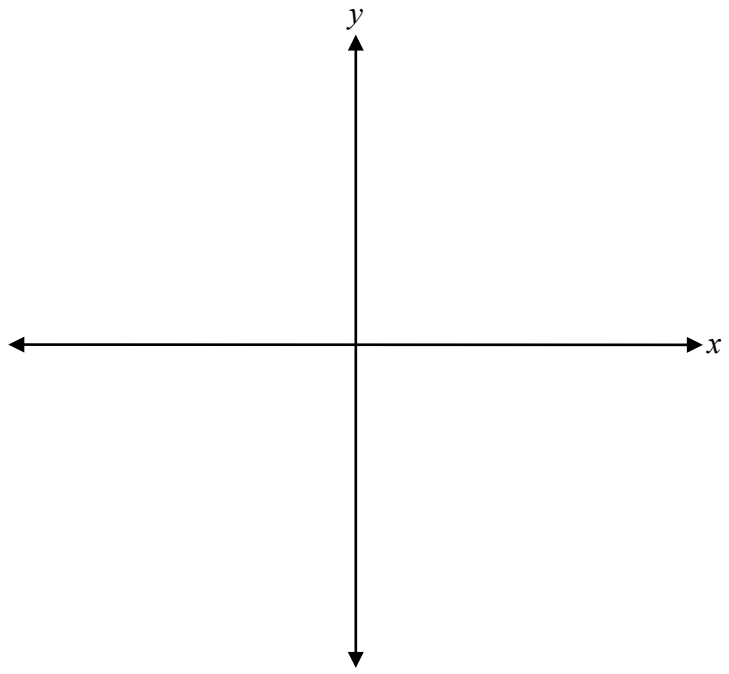
Question 39 — 2 marks — 131

Evaluate.

$$\frac{\cot\left(-\frac{5\pi}{6}\right)}{\sin\left(\frac{17\pi}{3}\right)}$$

Question 40 — 4 marks — 132

Sketch the graph of the function $f(x) = \dfrac{-1}{(x-1)^2}$ and determine the range.



Range: _____

Question 41

a) 1 mark b) 1 mark

133
134

Given $f(x) = \sqrt{x-2}$ and $g(x) = x^2 + 1$,

a) determine $g(f(x))$.

$g(f(x)) =$ _____

b) explain why the domain of $g(f(x))$ is restricted.

Question 42 — 3 marks — 135

Solve algebraically.

$$2\log_a 3 + \log_a 4 = 2, \text{where } a > 0$$

Question 43 — 2 marks — 136

Solve $\sec\theta + 2 = 0$ over the interval $[0,\ 2\pi]$.

Question 44 — 1 mark — 137

Determine the x-intercept of the graph of $f(x) = e^x - 1$.

Question 45 — 1 mark — 138

Given the 5th row of Pascal's triangle, determine the values of the next row.

1 4 6 4 1

Question 46 — 2 marks — 139

Evaluate.

$$\log_2 80 - \log_2 10$$

Question 47 — 1 mark — 140

State the amplitude of $f(x) = -2\sin(x - \pi) - 1$.

Question 48 — 3 marks — 141

Determine the exact value of $\cos 15^\circ$.

Question 49

a) 1 mark b) 1 mark

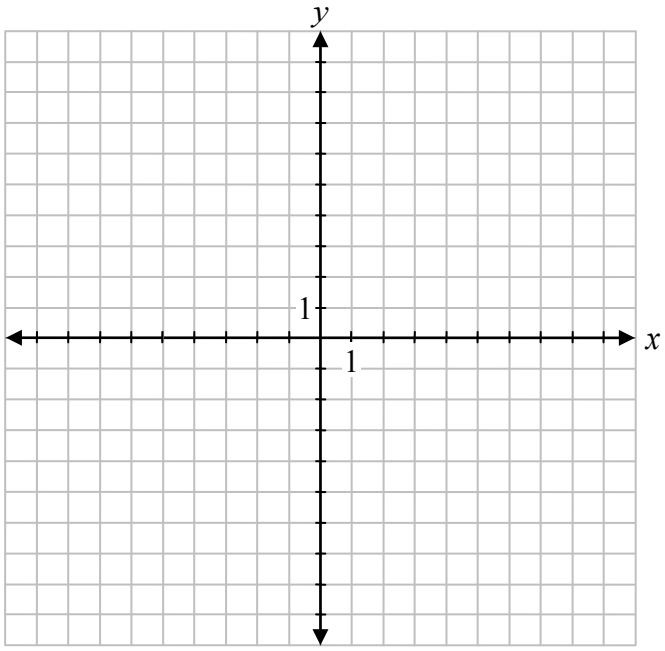
142
143

Given $f(x) = x^2 + 5x + 6,\ g(x) = x + 3,$ and $h(x) = f(x) - g(x),$

a) determine $h(x)$.

$h(x) =$ _____

b) sketch the graph of $y = h(x)$.



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