Grade 12
Pre-Calculus Mathematics
Achievement Test

Booklet 2

June 2018

Manitoba

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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: 3 hours

Numbers and Marks by Question Type

	Selected Response	Constructed Response	Marks
Booklet 1*	—	17	35
Booklet 2	9	22	54
Total	9	39	**89**

* The first 6 questions in *Booklet 1* require a 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.

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

Question 18 — 1 mark

Given $f(x) = x - 1,$ identify a point on the graph of $y = \sqrt{f(x)}$.

a) $(0,-1)$

b) $(3,2)$

c) $(1,0)$

d) $(0,1)$

Question 19 — 1 mark

Identify the total number of possible arrangements of 6 adults and 4 children seated in a row if the children must sit together.

a) $6!4!$

b) $7!4!$

c) $10!$

d) $6!$

Question 20 — 1 mark

Identify the exact value of $\sec\left(-\frac{7\pi}{3}\right)$.

a) -2

b) $-\frac{2}{\sqrt{3}}$

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

d) 2

Question 21 — 1 mark

Given $\log_x\left(\frac{1}{25}\right) = -2,$ identify the value of x.

a) -5

b) $-\frac{1}{5}$

c) $\frac{1}{5}$

d) 5

Question 22 — 1 mark

Identify the equation for all of the asymptotes on the graph of $y = \tan x$.

a) $x = k\pi,\ k \in \mathbb{Z}$

b) $x = 2k\pi,\ k \in \mathbb{Z}$

c) $x = \frac{\pi}{2} + k\pi,\ k \in \mathbb{Z}$

d) $x = \frac{\pi}{2} + 2k\pi,\ k \in \mathbb{Z}$

Question 23 — 1 mark

If $p(x) = 3(m)(x+1)^2$ is a cubic function with a y-intercept of $-12,$ identify the missing factor, m.

a) $m = x - 4$

b) $m = x + 4$

c) $m = x + 12$

d) $m = x - 12$

Question 24 — 1 mark

Identify the number of negative terms in the binomial expansion of $(x-y)^5$.

a) 2

b) 3

c) 5

d) 6

Question 25 — 1 mark

Given $f(x)=x^2$, identify which equation represents the graph of $y=f(x)$ after a translation of 5 units to the left.

a) $y=(x+5)^2$

b) $y=(x-5)^2$

c) $y=x^2-5$

d) $y=x^2+5$

Question 26 — 1 mark

When a polynomial, $p(x)$, is divided by $(x-7)$, the remainder is 24. Identify the only statement that must be true.

a) $x=7$ is a zero of $p(x)$

b) $p(7)=24$

c) $x=24$ is a zero of $p(x)$

d) the y-intercept is 24

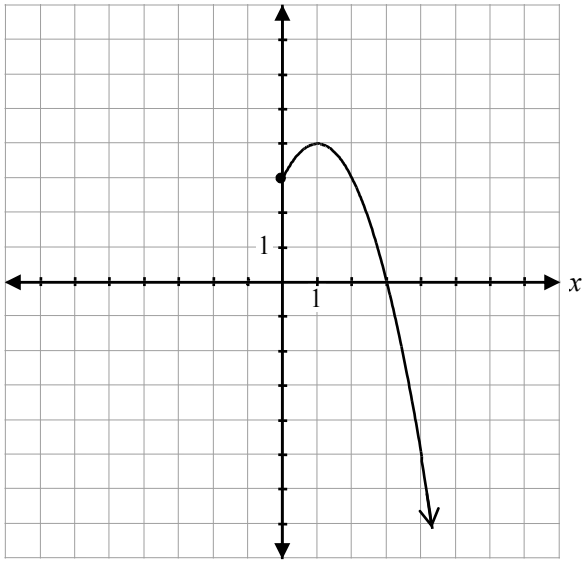
Question 27 — 1 mark — 118

Given $f(x) = \dfrac{(2x+1)(x-8)}{(x-8)(x+4)}$, state the equation(s) of the vertical asymptote(s).

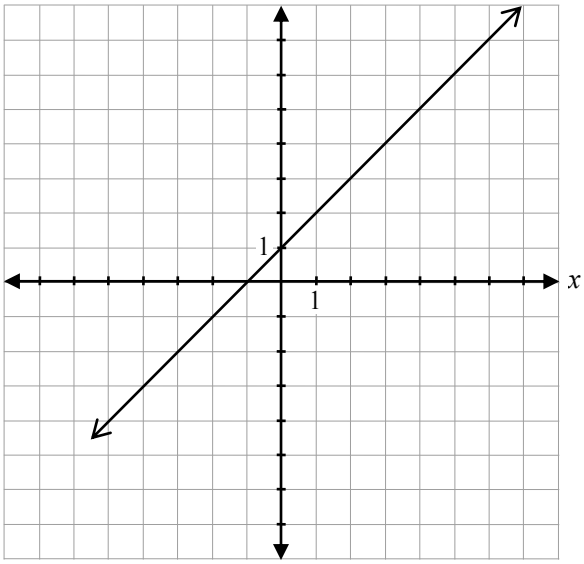
Question 28 — 2 marks — 119

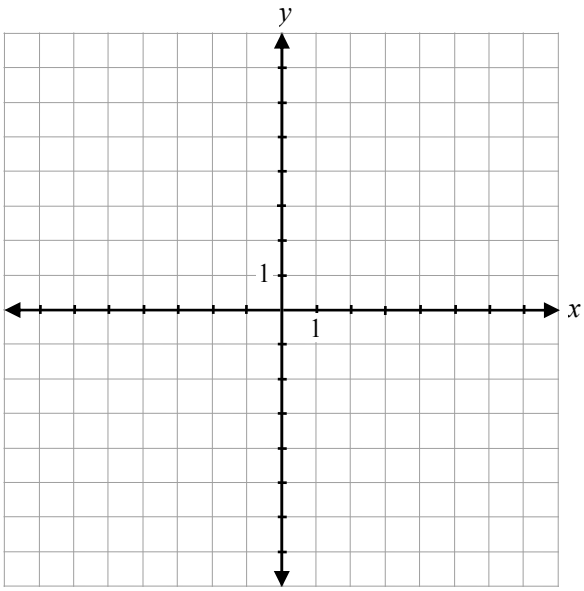
Given the graph of $(f \bullet g)(x)$ and $g(x)$, sketch the graph of $f(x)$.

$(f \bullet g)(x)$



$g(x)$





Question 29 — 1 mark — 120

Brian was asked to state the zeros of the polynomial $p(x) = (x+2)(x-5)(x-1)$.

Brian's response:

Zeros: $(x+2), (x-5), (x-1)$

Explain why his response is incorrect.

Question 30 — 2 marks — 121

Simplify ${}_{n+3}C_{2}$.

Question 31 — 2 marks — 122

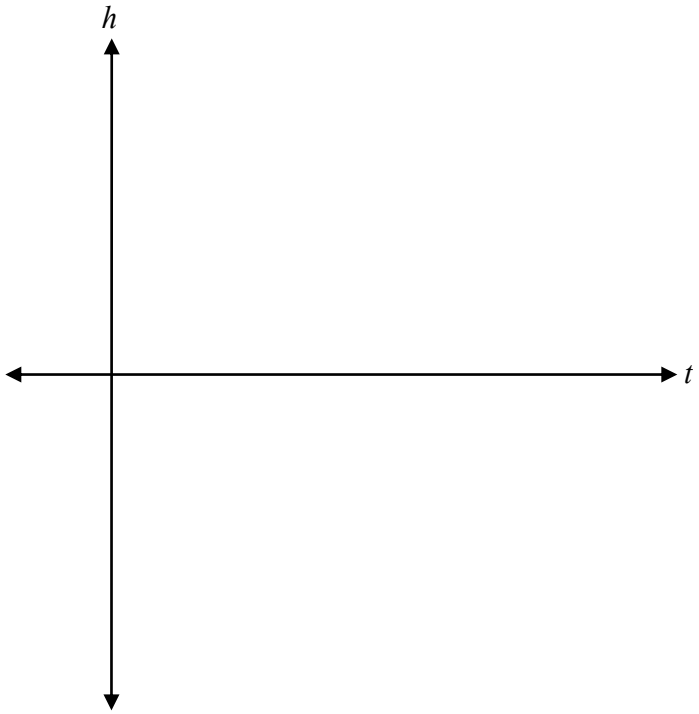
Verify that the equation $2\cos^2 x = \sin x + 1$ is true for $x = \frac{\pi}{6}$.

Question 32 — a) 2 marks b) 1 mark

123
124

The height of a fish jumping out of the water can be modelled by the function $h(t) = -t(t-1)(t-4)(t-5)$ where $h(t)$ is the height of the fish above or below the water in cm, and t is the time in seconds, $t \geq 0$.

a) Sketch a graph representing the height of the fish with respect to time over the interval $[0,5]$.



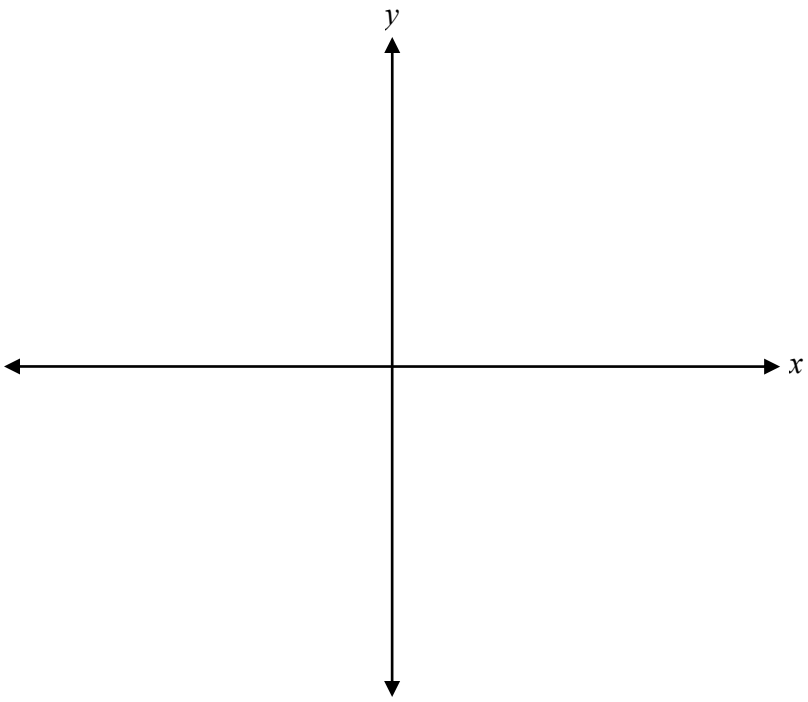
b) State, from the graph in a), the total number of seconds that the fish is above the water.

Question 33 — 1 mark — 125

Describe the behaviour of the graph of $y = 5^x + 4$ as it approaches $y = 4$.

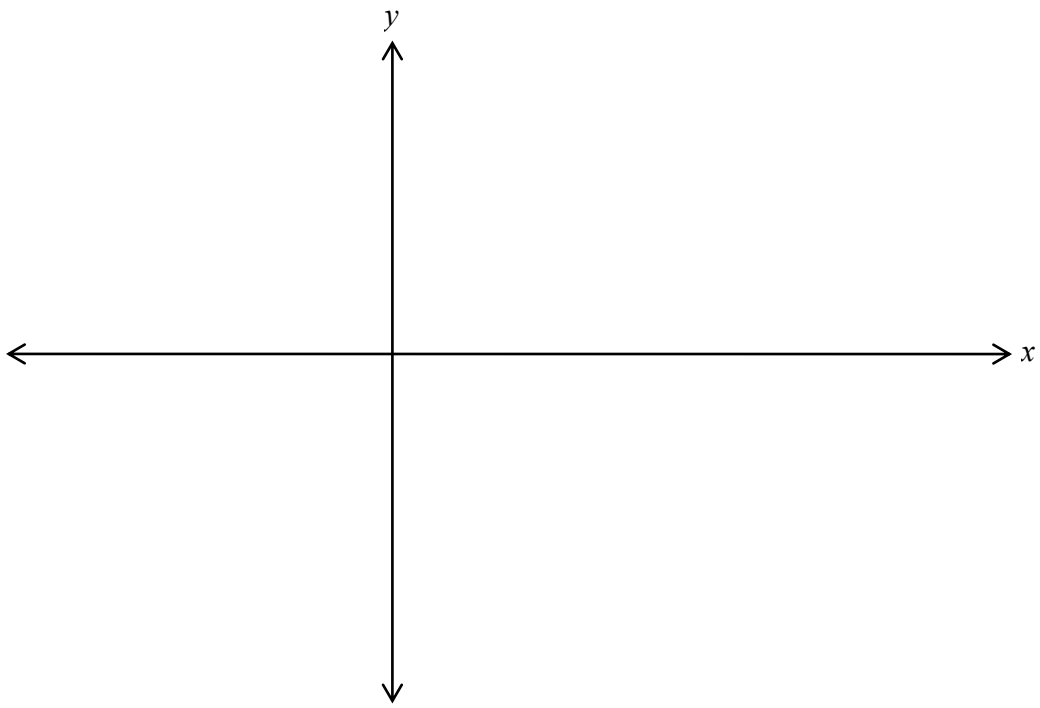
Question 34 — 1 mark — 126

Sketch the angle of 6 radians in standard position.



Question 35 — 4 marks — 127

Sketch the graph of the function $y = 4\sin\left(\frac{\pi}{3}x\right) - 2$ over the domain $[-3, 6]$.



Question 36 — a) 1 mark b) 1 mark

128
129

Given $f(x) = 3x - 12$ and $g(x) = x - 4$,

a) determine the equation of $h(x) = \left(\frac{f}{g}\right)(x)$.

$h(x) =$ _____

b) describe what the non-permissible value represents on the graph of $h(x)$.

Question 37 — 2 marks — 130

Determine an equation of a radical function, $f(x)$, with a domain of $x \geq 5$ and a range of $y \geq -2$.

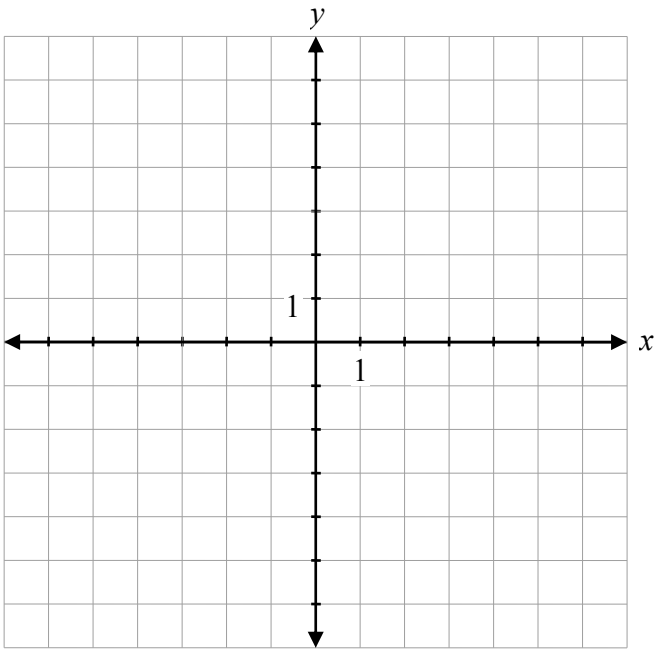
$f(x) =$ _____

Question 38 — 3 marks — 131

Determine the exact value of $\cos\left(\frac{17\pi}{12}\right)$.

Question 39 — 4 marks — 132

Sketch the graph of $y = \frac{1}{2}\sqrt{-x} + 1$.



Question 40 — 2 marks — 133

Given $f(x) = \frac{3x}{4} + 9,$ determine the equation of $f^{-1}(x).$

Question 41 — 1 mark — 134

Describe the end behaviour of the polynomial function $p(x) = -(x-2)(x+3)^2$.

Question 42

a) 2 marks b) 1 mark

135
136

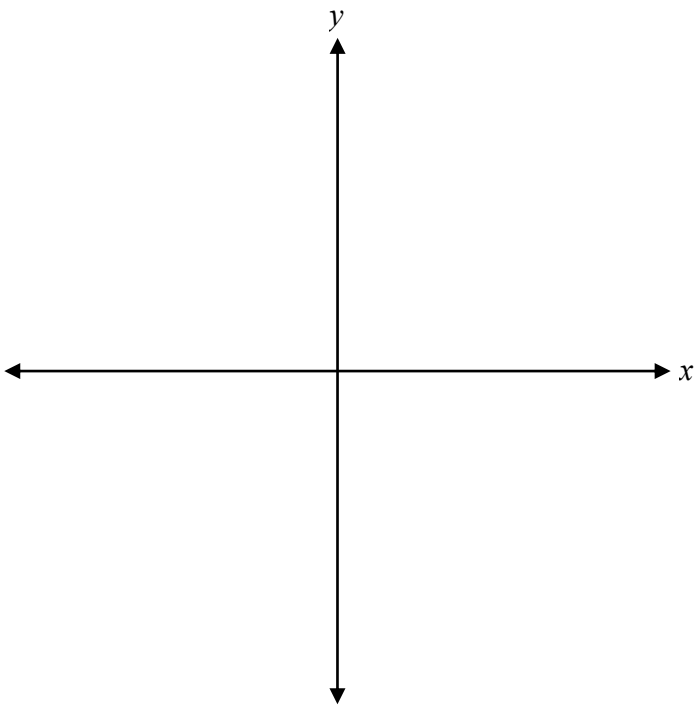
Given $\csc\theta = -4$ and θ is in quadrant IV,

a) determine the exact value of $\cos\theta$.

b) determine the exact value of $\cot\theta$.

Question 43 — 2 marks — 137

Sketch the graph of the function $f(x) = \dfrac{10}{x^2 + 2}$.



Question 44 — 1 mark — 138

Explain why only one of the following equations could be solved algebraically without using logarithms.

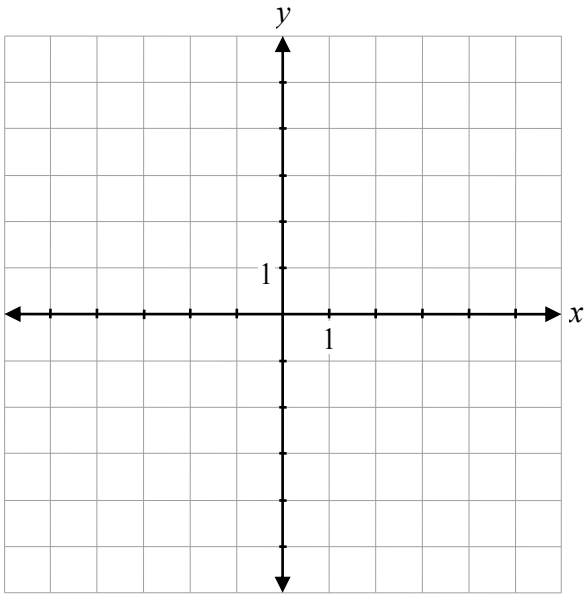
$3^{5x} = 6^{2x-1}$ or $16^{2x+3} = \left(\frac{1}{2}\right)^{4x-5}$

Question 45 — 1 mark — 139

Given a graph of $y = f(x)$, describe how to sketch the graph of $y = |f(x)|$.

Question 46 — 2 marks — 140

Sketch the graph of $y = \log_3(x + 4)$.



Question 47 — 3 marks — 141

Solve, algebraically.

$$\log x + \log 4 - \log(x - 2) = \log 5$$

Question 48 — 2 marks — 142

Given $\sin\theta = \frac{1}{2}$, determine all possible values of θ over the interval $[-2\pi, 2\pi]$.

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