Grade 12
Pre-Calculus Mathematics
Achievement Test

# Booklet 2

January 2018

Manitoba

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*** | — | 15 | 32 |
| **Booklet 2** | 9 | 25 | 57 |
| **Total** | 9 | 40 | **89** |

\* The first 5 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 16

Identify $10°$ in radians.

a) $\dfrac{1800}{\pi}$

b) $\dfrac{\pi}{1800}$

c) $\dfrac{18}{\pi}$

d) $\dfrac{\pi}{18}$

## Question 17

The polynomial function, $P(x) = a(x-1)^2(x+4)^2$, has a $y$-intercept of $-8$.

Identify the value of $a$.

a) $-2$

b) $-\dfrac{1}{2}$

c) $\dfrac{1}{2}$

d) $2$

## Question 18      1 mark

Identify the value of $\log_4\left(\frac{1}{16}\right)$.

a) $-2$

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

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

d) $2$

## Question 19      1 mark

Given the angle $\frac{25\pi}{7}$, identify the coterminal angle on the interval $[-2\pi, 0]$.

a) $\frac{18\pi}{7}$

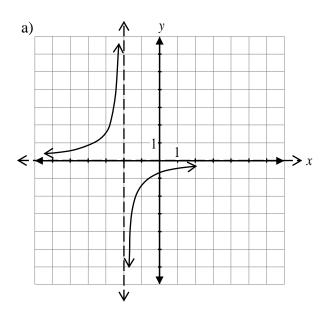b) $\frac{11\pi}{7}$

c) $-\frac{3\pi}{7}$
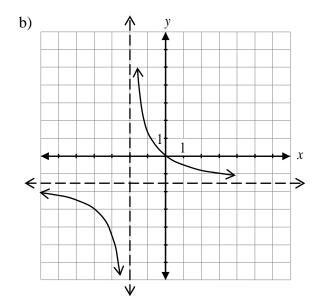
d) $-\frac{10\pi}{7}$

## Question 20      1 mark
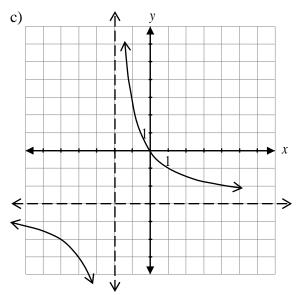
Identify which expression cannot be evaluated.

a) $_7P_0$

b) $_7P_6$

c) $_7P_7$

d) $_7P_8$

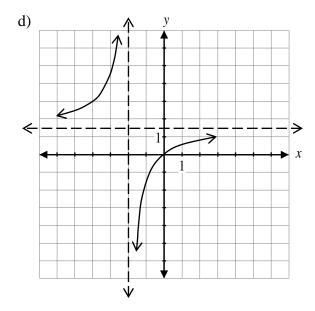Identify the graph of $f(x) = \dfrac{-3x}{2x+4}$.

a)



b)



c)



d)

## Question 22                                                    1 mark

Given a point $(-2,0)$ on the graph of $y = f(x)$, identify the coordinates of the corresponding

point on the graph of $y = 4f\left(\dfrac{1}{2}x\right)$.

a) $(-8,0)$

b) $(-4,0)$

c) $(-2,0)$

d) $(-1,0)$

## Question 23                                                    1 mark

Identify the non-permissible value of $\theta$ for the expression $\dfrac{\cos\theta}{1+\sin\theta}$.

a) $\dfrac{\pi}{2}$

b) $\pi$

c) $\dfrac{3\pi}{2}$

d) $2\pi$

## Question 24                                                    1 mark
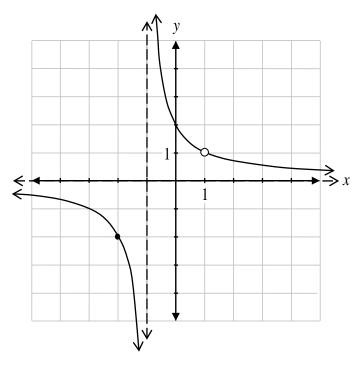
Identify the function with an asymptote at $x = -3$.

a) $y = \log(x+3)$

b) $y = \log x + 3$

c) $y = \log(x-3)$

d) $y = \log x - 3$

Evaluate the following expression.

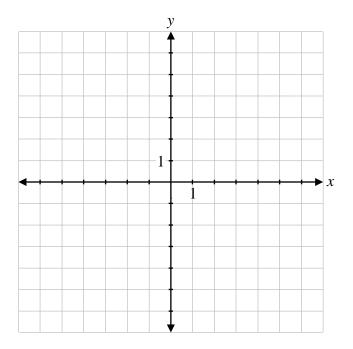$$\tan\left(\frac{2\pi}{3}\right)\csc\left(\frac{-2\pi}{3}\right) + \cos\left(3\pi\right)$$
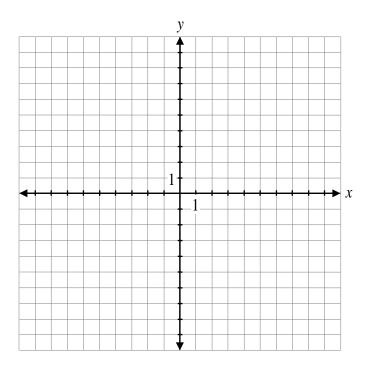
State the range of the graph below.



Range: _____

Sketch the graph of the function $f(x) = \dfrac{2x^2 - 5x}{x}$.

State a possible value of $n$ if the polynomial function $P(x) = (x-1)^2 (x+2)^n$ has a range of $[0, \infty)$.

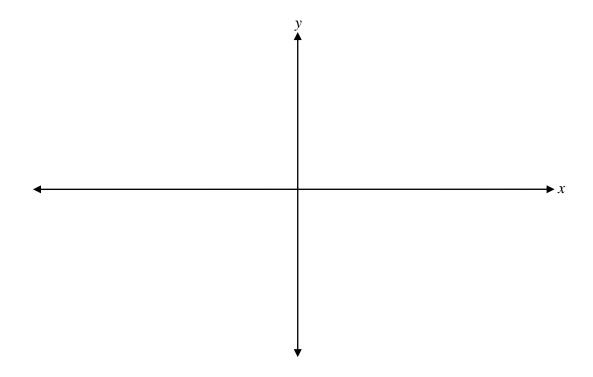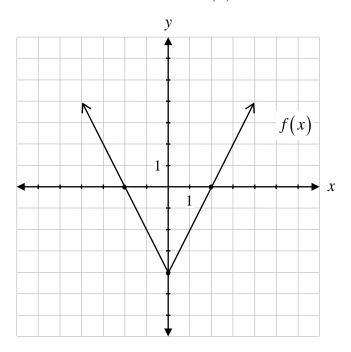Sketch the graph of $y = \left(\dfrac{1}{2}\right)^{x-1}$.

Solve.

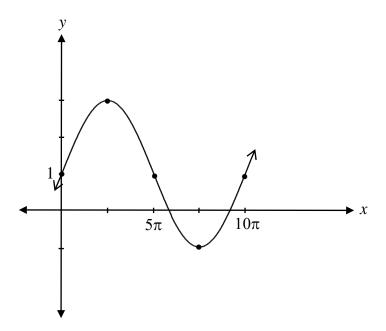$$\log_x 27 = 3$$

Sketch at least two periods of the graph $y = \tan x$.

Given the graph of $f(x)$, determine the domain of $\dfrac{1}{f(x)}$.



Domain: _____

Determine the values of A, B, and D of the sinusoidal function in the form $y = A \sin(Bx) + D$.



A = _____

B = _____

D = _____

Determine if the point $\left( -\dfrac{\sqrt{7}}{5}, \dfrac{2}{5} \right)$ is on the unit circle.

Justify your answer.

Solve, algebraically.
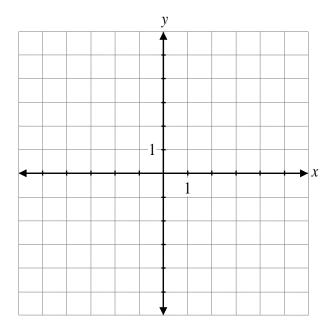
$$\frac{_nC_5}{_nC_4} = 6$$

Given $\sin \alpha = \dfrac{4}{5}$, where $\alpha$ is in quadrant II, determine the exact value of $\sin 2\alpha$.

Given the functions $f(x) = x + 1$ and $g(x) = \sqrt{x}$,

a) determine the equation of $g(f(x))$.

$g(f(x)) = $ _____

b) sketch the graph of $g(f(x))$.
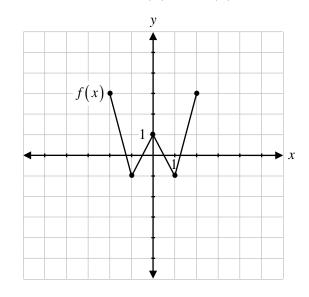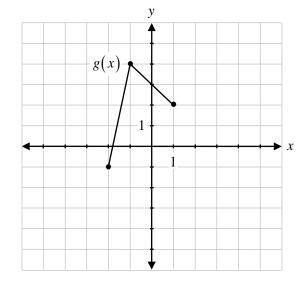
Steve is asked to determine an equation with a larger period than the period of the graph of $y = \cos(2x)$.

Justify why Steve's answer of $y = \cos(6x)$ is incorrect.
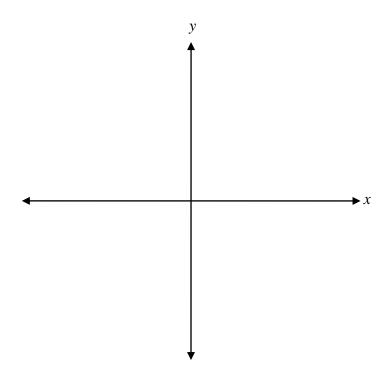
Given the graphs of $f(x)$ and $g(x)$,



a) determine the value of $(f \cdot g)(-1)$.

b) determine the value of $g(f(0))$.

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

The point $\left(-\sqrt{3}, 1\right)$ is on the terminal arm of an angle $\theta$, in standard position.

a) Determine $\tan\theta$.

b) Determine a possible value of $\theta$, in radians.

## Question 42

1 mark

Describe the transformation used to obtain the graph of $y = \log_5 x$ given the graph of $y = 5^x$.

## Question 43

2 marks

Solve $\sin \theta = -\dfrac{\sqrt{3}}{2}$, where $\theta \in \mathbb{R}$.

## Question 44

Given that the point $(a,b)$ is on the graph of $f(x)$, describe how you would determine the corresponding point on the graph of $y = \sqrt{f(x)}$.

## Question 45

Evaluate.

$$\cos\left(\frac{\pi}{20}\right)\cos\left(\frac{\pi}{5}\right) - \sin\left(\frac{\pi}{20}\right)\sin\left(\frac{\pi}{5}\right)$$

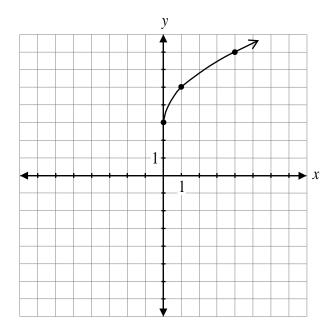Describe the transformations used to obtain the graph of the function $y = f(-x+6)-8$ from the graph of $y = f(x)$.

State the equations of all the asymptotes of the function, $y = \dfrac{1}{3x+1}$.

Determine the zeros of the polynomial function $P(x) = 2x^3 + 5x^2 - 4x - 3$.

Determine the equation of the radical function represented by the graph.



$y = $ _____

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