Grade 12
Pre-Calculus Mathematics
Achievement Test

Booklet 2

June 2025

Manitoba

Grade 12 pre-calculus mathematics achievement test.
Booklet 2. June 2025

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Manitoba Education and Early Childhood Learning
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Grade 12 Pre-Calculus Mathematics Achievement Test

DESCRIPTION

Time Required to Complete the Test: 3 hours
Additional Time Allowed: 30 minutes

Number and Marks by Question Type

	Selected Response	Constructed Response	Marks
Booklet 1	—	15	33
Booklet 2	**9**	**22**	**57**
Total	9	37	**90**

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

DIRECTIONS

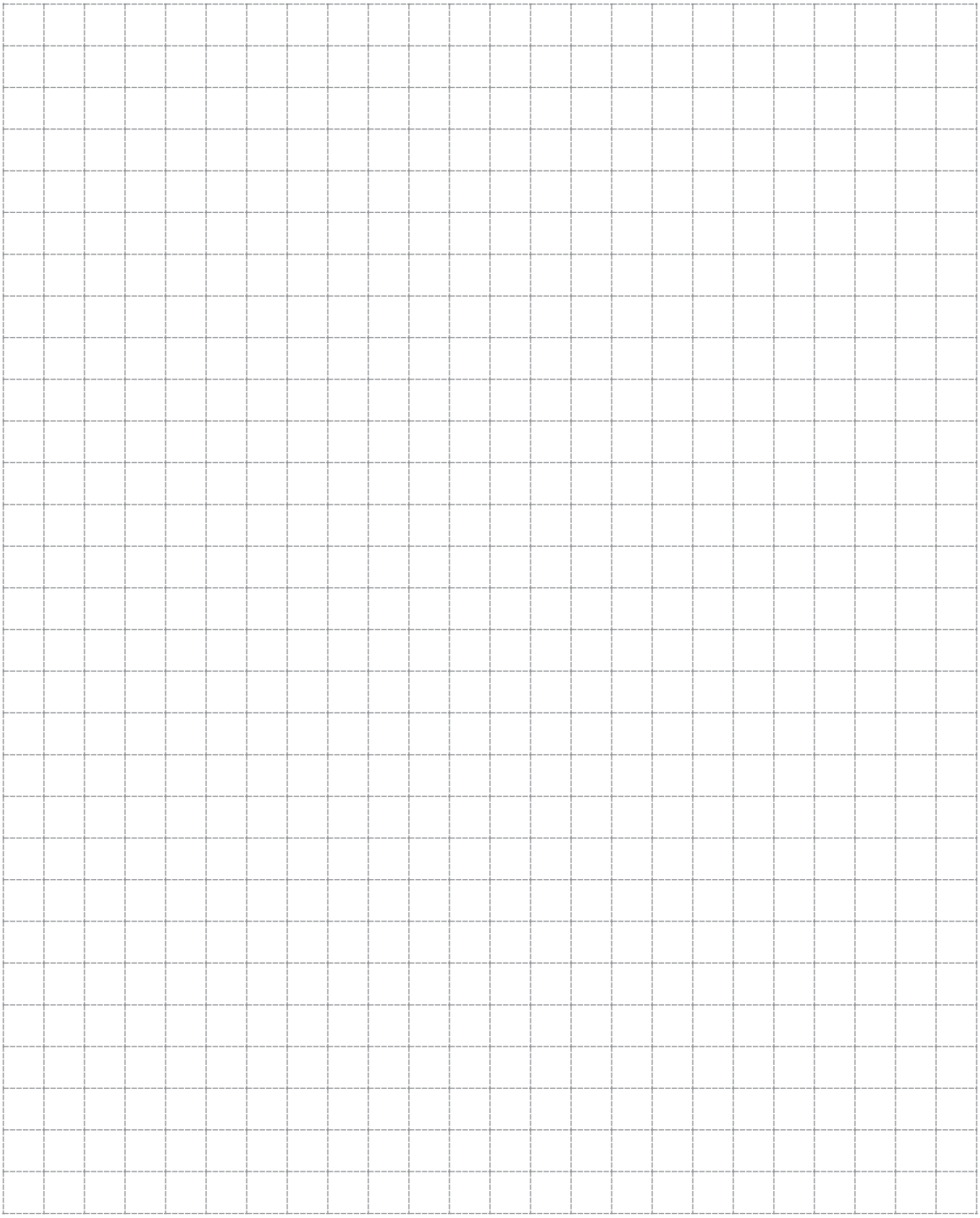
Selected Response Questions

- 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.
- Write each solution in the space provided.
- For full marks, your answer must show all pertinent diagrams, calculations, and explanations.
- Your solutions should be neat, clear, and well organized.

NO MARKS WILL BE AWARDED FOR WORK DONE ON THIS PAGE.



Question 16 — 1 mark

Identify the number of *x*-intercepts on the graph of the polynomial function, $p(x) = 3x(x-8)(x^2+5)$.

a. 1

b. 2

c. 3

d. 4

Question 17 — 1 mark

Identify the equation that represents the graph of $y = x^2 - 3$ after a reflection over the *x*-axis.

a. $y = -x^2 - 3$

b. $y = x^2 - 3$

c. $y = x^2 + 3$

d. $y = -x^2 + 3$

Question 18 — 1 mark

Given $2^{\log_2 3} = x$, identify the value of *x*.

a. 1

b. 3

c. 6

d. 8

Question 19 — 1 mark

Identify the *y*-intercept on the graph of $y = \dfrac{x-3}{x^2-5x+6}$.

a. -3

b. -2

c. $-\dfrac{1}{2}$

d. 3

Question 20 — 1 mark

Identify the total number of arrangements for 10 students and 2 teachers to sit in a row if the teachers must sit together.

a. $10!2!$

b. $11!$

c. $11!2!$

d. $12!$

Question 21 — 1 mark

Identify which expression represents the remainder when the polynomial $P(x)$ is divided by $(x-4)$.

a. $P(-4)$

b. $P(4)$

c. $P(x-4)$

d. $P(x+4)$

Question 22 — 1 mark

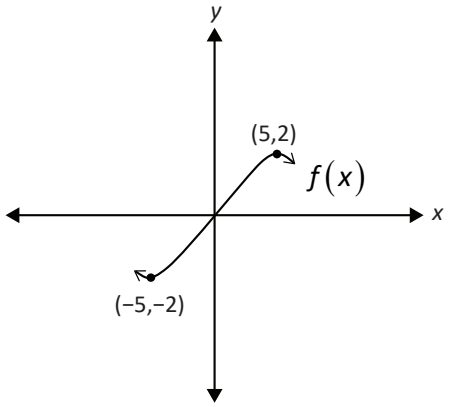
Identify the period of the graph of the sinusoidal function.

a. 10π

b. 10

c. 20π

d. 20



Question 23 — 1 mark

Identify an equivalent expression for $\log_3 9 + \log_3 5$.

a. $\log_3 14$

b. $2\log_3 5$

c. $\log_3 45$

d. $\log_3\left(\frac{9}{5}\right)$

Question 24 — 1 mark

Identify the coterminal angle(s) of $\theta = -\frac{11\pi}{10}$ over the interval $[-3\pi, \pi]$.

a. $\theta = \frac{9\pi}{10}$

b. $\theta = -\frac{31\pi}{10}, -\frac{21\pi}{10}$

c. $\theta = -\frac{31\pi}{10}, \frac{9\pi}{10}$

d. $\theta = -\frac{21\pi}{10}, \frac{9\pi}{10}$

Question 25 — 3 marks

117

Express $p(x) = x^3 - 13x - 12$ in completely factored form.

$p(x) =$ _____

Question 26 — 3 marks

118

Verify, by substitution, that the equation $\frac{\cos^2\theta}{\sin^2\theta} = \frac{2\csc\theta}{\sec^2\theta}$ is true for $\theta = \frac{\pi}{6}$.

Left-Hand Side	Right-Hand Side

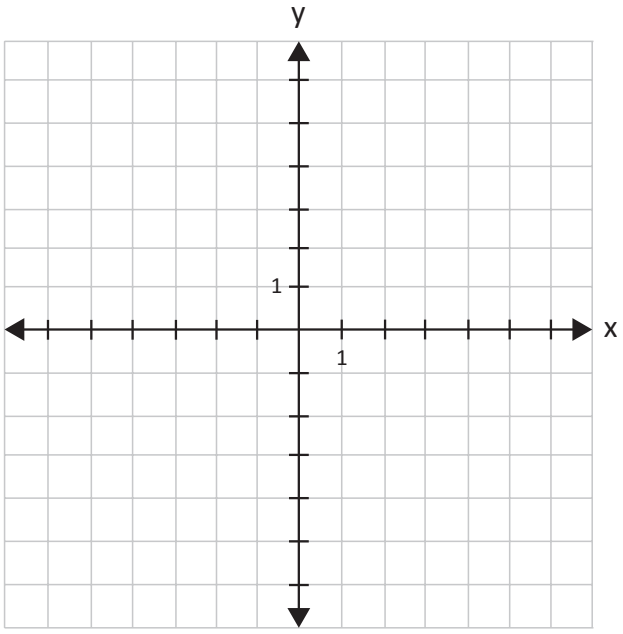
Question 27 — a) 1 mark b) 2 marks

119
120

Given $f(x) = \log_3 x + 2$,

a) determine the *x*-intercept of $f(x) = \log_3 x + 2$.

b) sketch the graph of $f(x) = \log_3 x + 2$.



Question 28 — 2 marks

121

Evaluate.

$$\sec^2\left(\frac{5\pi}{4}\right) \cdot \tan^2\left(-\frac{2\pi}{3}\right)$$

Question 29 — 1 mark

122

Given the functions $f(x) = x - 3$ and $g(x) = \sqrt{x} + 2$, state the domain of $g(f(x))$.

Question 30 — 1 mark

123

Evaluate.

$$\sin 70^\circ \cos 25^\circ - \cos 70^\circ \sin 25^\circ$$

Question 31 — 2 marks

124

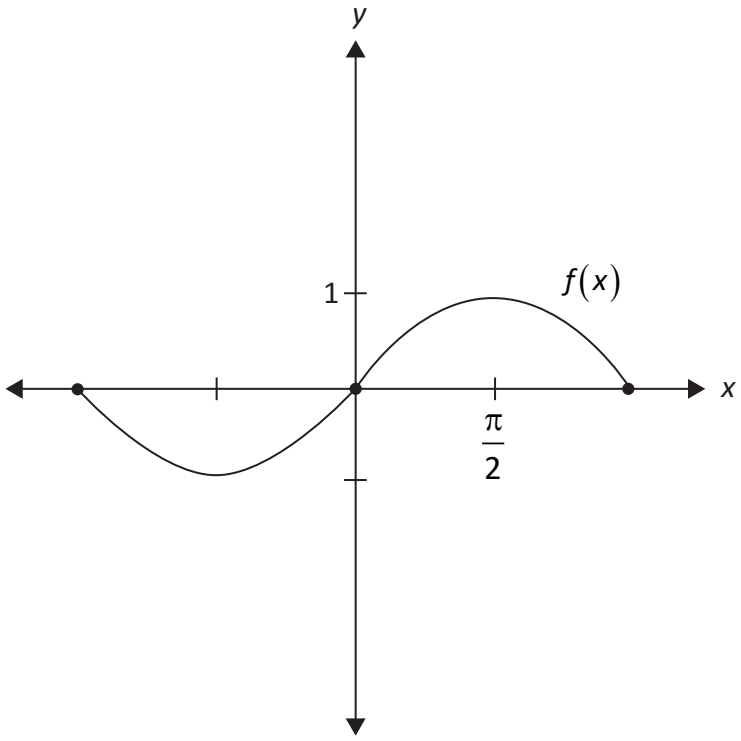
Solve, algebraically.

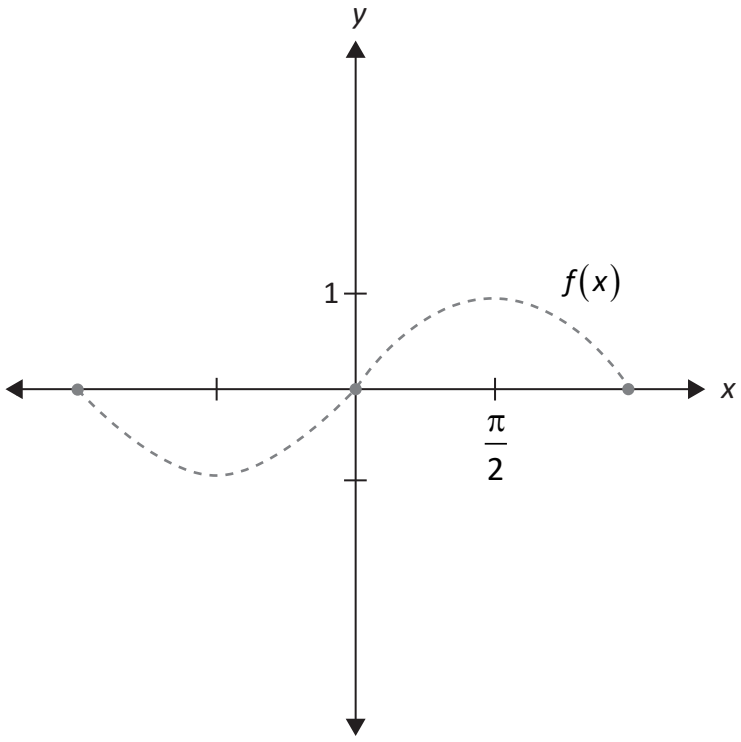
$$\log_{15}\left(x^2-1\right)=1$$

Question 32 — 2 marks

125

Given the graph of $y = f(x)$, sketch the graph of $y = \dfrac{1}{f(x)}$.





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

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

Question 33 — a) 3 marks b) 1 mark

126
127

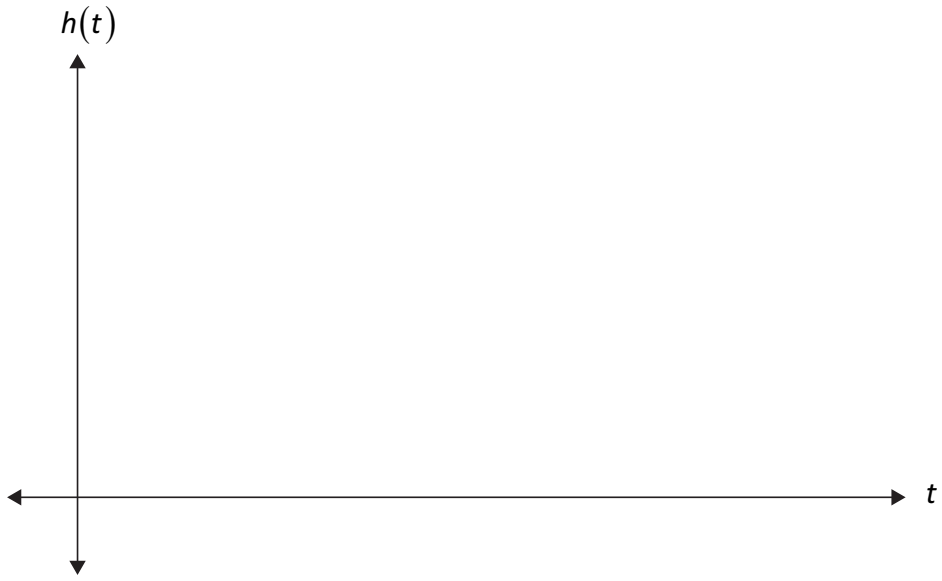
A light is attached to the end of a blade of a wind turbine. The height of the light, with respect to the ground, follows the sinusoidal equation:

$$h(t) = 80\cos\left(\frac{\pi}{2}t\right) + 240$$

where $h(t)$ is the height of the light with respect to the ground, measured in feet and,

t is the time, measured in seconds.

a) Sketch the graph of the height of the light with respect to the ground, over an interval of 6 seconds.



b) If the turbine begins to rotate faster, describe the resulting effect on the period of the graph of $h(t)$.

Question 34 — 1 mark — 128

Elodie was asked to determine the total number of arrangements of the letters in the word EXCELLENCE.

Her solution:

$10! = 3628\ 800$

Describe her error.

Question 35 — a) 3 marks b) 1 mark

129
130

Given that $\cos\alpha = -\frac{4}{7}$ where α is in quadrant III and $\sin\beta = \frac{5}{13}$ where β is in quadrant II, determine the exact value of:

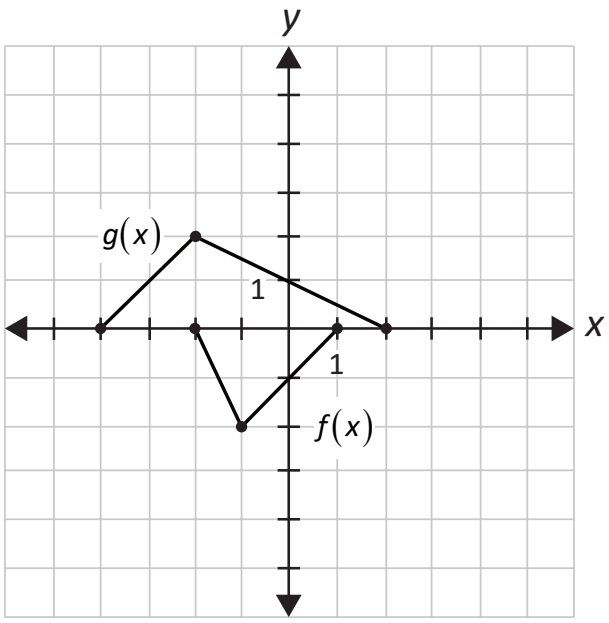
a) $\cos(\alpha + \beta)$

b) $\sec(\alpha + \beta)$

Question 36 — 2 marks

131

Determine the equation for $g(x)$, in terms of $f(x)$.



$g(x) =$ _____

Question 37 — 1 mark

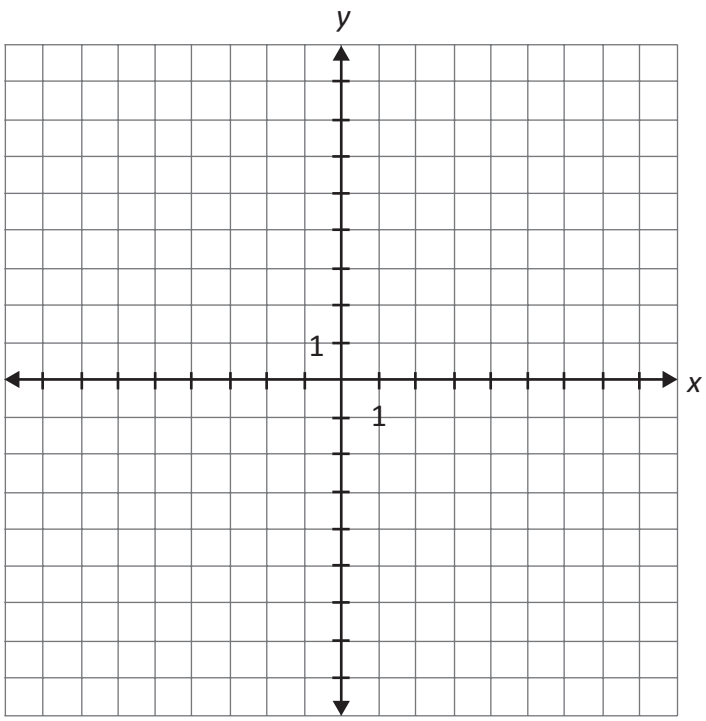
132

State possible values for m and n that satisfy the equation, $\log_m n = 5$.

Question 38 — 4 marks

133

Sketch the graph of $f(x) = \dfrac{x-4}{x^2-7x+12}$.



Question 39 — 1 mark

134

Justify that the value of ${}_3P_4$ does not exist.

Question 40 — 1 mark — 135

State the range of the sinusoidal function that has the following characteristics:

- an amplitude of 3
- a maximum at $\left(\frac{\pi}{2}, 1\right)$

Question 41 — 3 marks

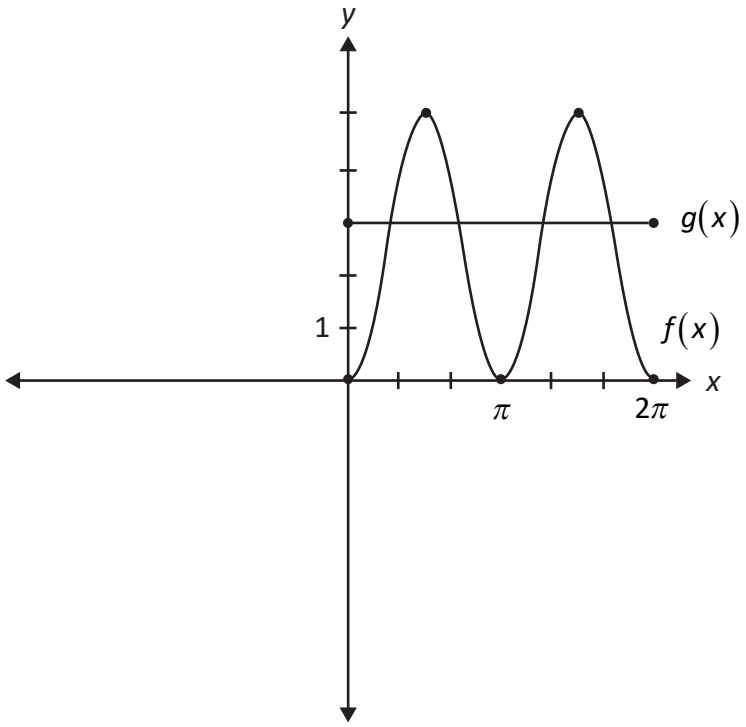
136

Solve, algebraically.

$${}_{n}C_{2} = 15$$

Question 42 — 1 mark

Describe how to use the graphs of $f(x) = 5\sin^2 x$ and $g(x) = 3$ to solve the equation, $5\sin^2 x = 3$, over the interval $[0, 2\pi]$.



Question 43 — 3 marks

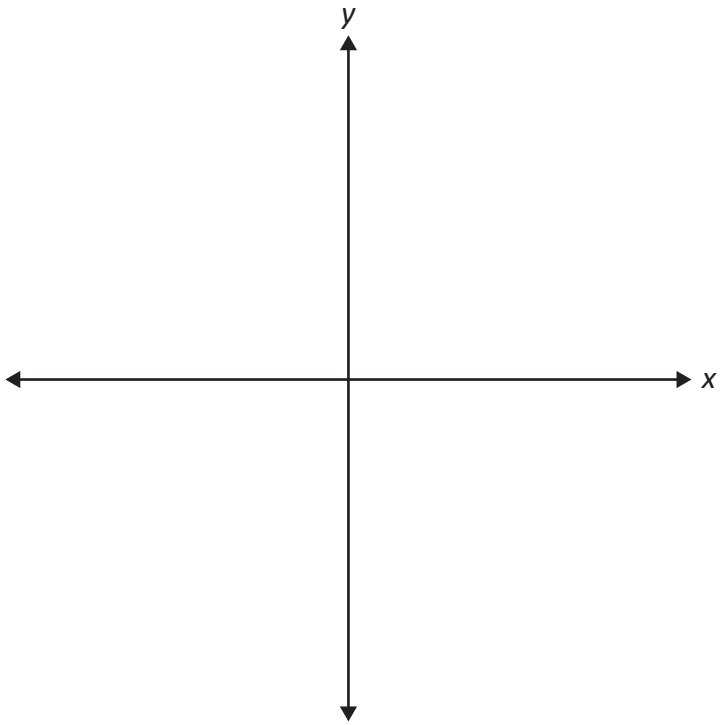
138

Solve, algebraically.

$$2\log_3 5 - \frac{1}{3}\log_3 125 = \log_3 a$$

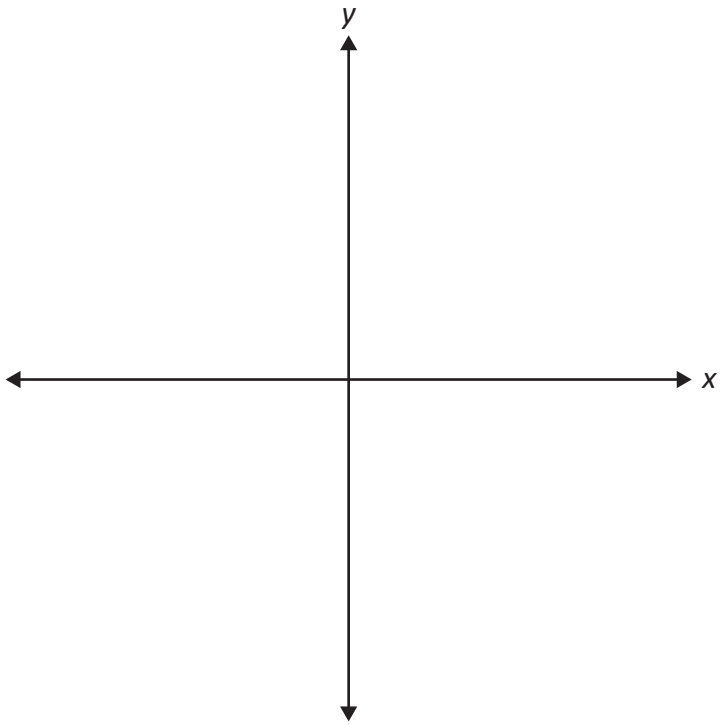
Question 44 — 1 mark — 139

Sketch the angle, $\frac{-7\pi}{12}$, in standard position.



Question 45 — 3 marks — 140

Sketch the graph of $p(x) = -(x-1)(x-2)(x+4)^2$.



Question 46 — 2 marks — 141

The point, $P(\theta) = \left(-\frac{1}{6}, y\right)$, lies on the unit circle and is located in Quadrant III. Determine the exact value of $\csc\theta$.

NO MARKS WILL BE AWARDED FOR WORK DONE ON THIS PAGE.