

Grade 12
Pre-Calculus Mathematics
Achievement Test

Booklet 2

June 2015

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Instructions

Selected Response Questions

- There are 9 questions each worth one mark.
- 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 20 questions worth a total of 50 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 14

1 mark

There are 2 types of pencils, 3 colours of highlighters, and 5 styles of pens.

If you must select one of each to form a set, how many different sets of writing instruments are possible?

- a) 10
- b) 11
- c) 25
- d) 30

Question 15

1 mark

The point $P(\theta)$ lies on the unit circle. What are the coordinates of the point P if $\theta = 120^\circ$?

- a) $\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$
- b) $\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$
- c) $\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
- d) $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

Question 16**1 mark**

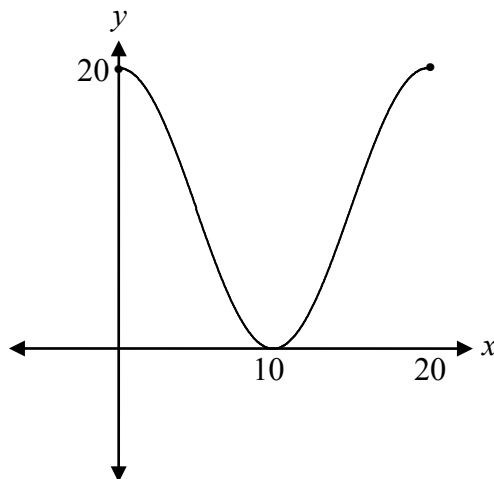
Identify the function that has a domain of $\{x|x \geq 7\}$ and a range of $\{y|y \geq 0\}$.

- a) $f(x) = \sqrt{x} + 7$
- b) $f(x) = \sqrt{x} - 7$
- c) $f(x) = \sqrt{x+7}$
- d) $f(x) = \sqrt{x-7}$

Question 17**1 mark**

Using $y = -10 \cos[B(x - C)] + D$, the value of C that corresponds to the following graph is:

- a) 5
- b) 10
- c) 15
- d) 20



Question 18

1 mark

Given the following row of Pascal's Triangle, identify the binomial expansion with these coefficients.

1 5 10 10 5 1

a) $(x + y)^4$

b) $(x + y)^5$

c) $(x + y)^6$

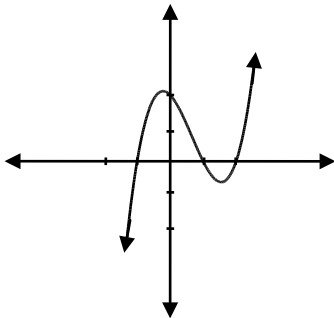
d) $(x + y)^7$

Question 19

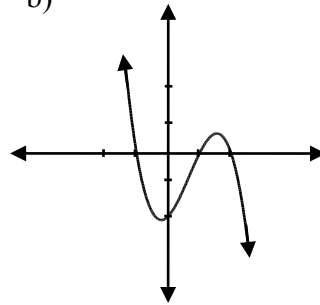
1 mark

Identify the graph of the function $f(x) = -(x - 2)(x - 1)^2(x + 1)$.

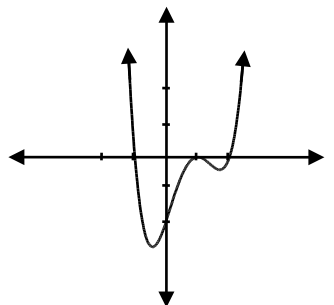
a)



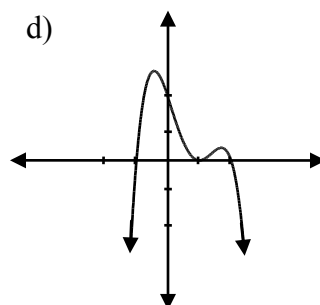
b)



c)



d)



Question 20**1 mark**

Determine the value of $\log_9(\log_3 27)$.

- a) $\frac{1}{3}$
- b) $\frac{1}{2}$
- c) 2
- d) 3

Question 21**1 mark**

If (x, y) is a point on the graph of $y = f(x)$, identify the coordinates of this point on the graph of $g(x) = f(2x) + 5$.

- a) $\left(\frac{x}{2}, y + 5\right)$
- b) $(2x, y + 5)$
- c) $\left(\frac{x}{2}, y - 5\right)$
- d) $\left(\frac{x}{2} - 5, y\right)$

Question 22

1 mark

Identify an equivalent expression for $1 + \log_2 5$.

- a) $\log_2 5$
- b) $\log_2 7$
- c) $\log_2 10$
- d) $\log_2 11$

Solve:

$$2\log_4 x - \log_4(x + 3) = 1$$

The following transformations are applied to $f(x)$, resulting in a new function, $g(x)$.

- reflection over the y -axis
- horizontal translation of 3 units to the right
- vertical translation of 4 units down

Write the equation of $g(x)$ in terms of $f(x)$.

$$g(x) = \underline{\hspace{15em}}$$

Question 25

a) 3 marks b) 1 mark

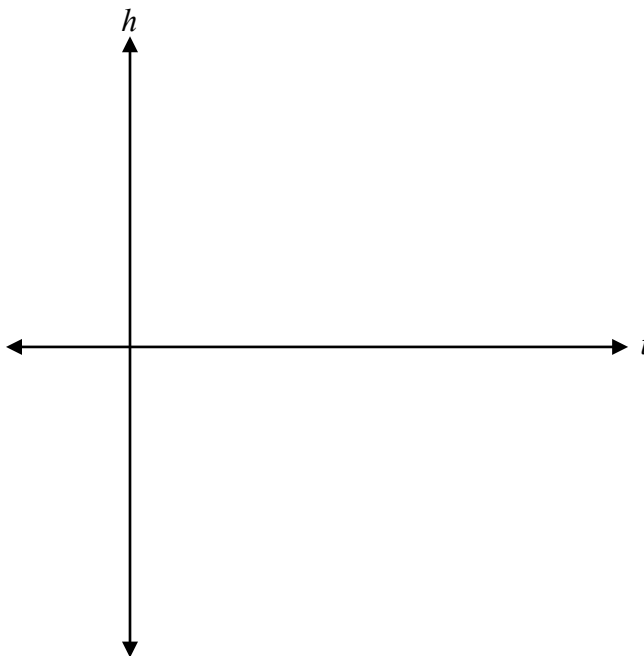
116
117

The height of a bicycle pedal as the bicycle is moving at a constant speed can be represented by the following function:

$$h(t) = 15 \cos \frac{2\pi}{5}t + 30$$

where h is the height of the pedal above the ground, in cm, and t is the time, in seconds.

a) Sketch a graph of at least one period of this function, where $t \geq 0$.



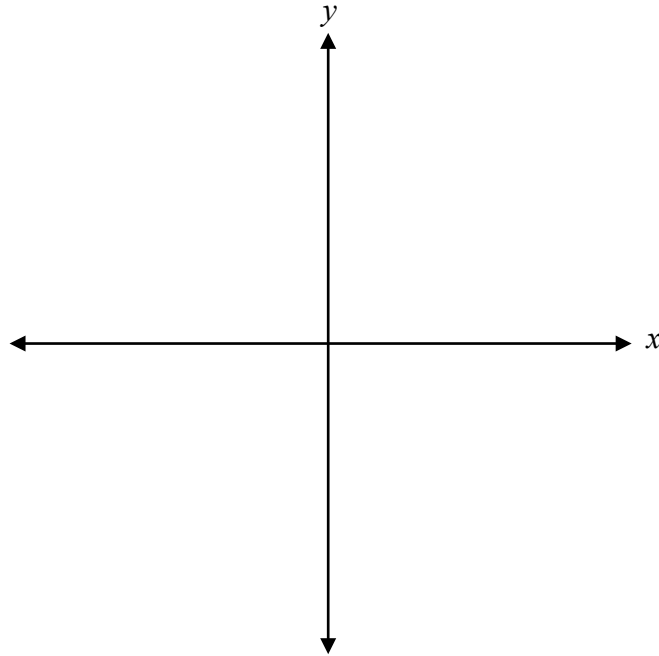
b) Determine the height of the bicycle pedal at 7.5 seconds.

Question 26

4 marks 118

Sketch the graph of the function $f(x)$ and determine the y -intercept.

$$f(x) = \frac{4}{(x-2)(x+2)}$$



y -intercept: _____

Kim solved the following logarithmic equation:

$$\log_2\left(-\frac{x}{3}\right) = \log_2(x - 4)$$

$$-\frac{x}{3} = x - 4$$

$$-x = 3x - 12$$

$$-4x = -12$$

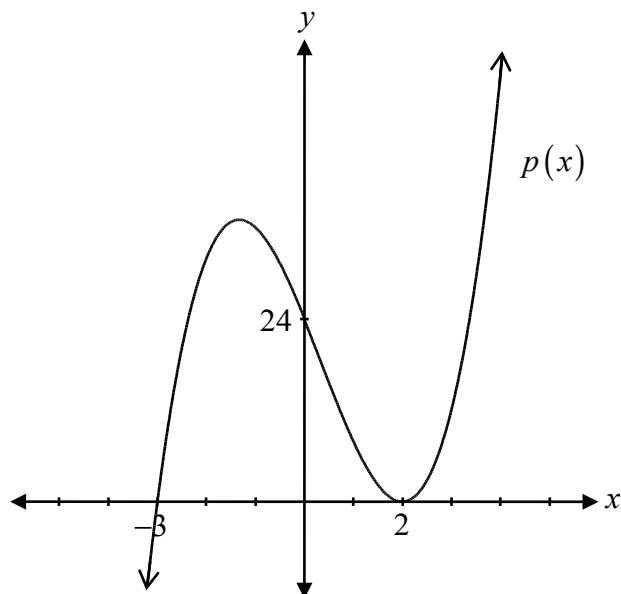
$$\cancel{x = 3}$$

Explain why $x = 3$ is an extraneous solution.

Question 28

3 marks 120

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



$p(x) =$ _____

Determine the coterminal angles with $\frac{2\pi}{3}$ over the interval $[-2\pi, 4\pi]$.

Question 30

a) 1 mark b) 1 mark

122
123

a) Solve the following equation:

$$0 = \sqrt{4x - 8} - 2$$

b) Explain how your answer in a) is related to the graph of $y = \sqrt{4x - 8} - 2$.

Determine the exact value of $\sin \frac{13\pi}{12}$.

Question 32

a) 2 marks b) 1 mark

125
126

Given the functions $f(x) = x + 2$ and $g(x) = \frac{1}{x-5}$:

- a) Determine the equation of the composite function $f(g(x))$ and its domain.

$f(g(x)) =$ _____

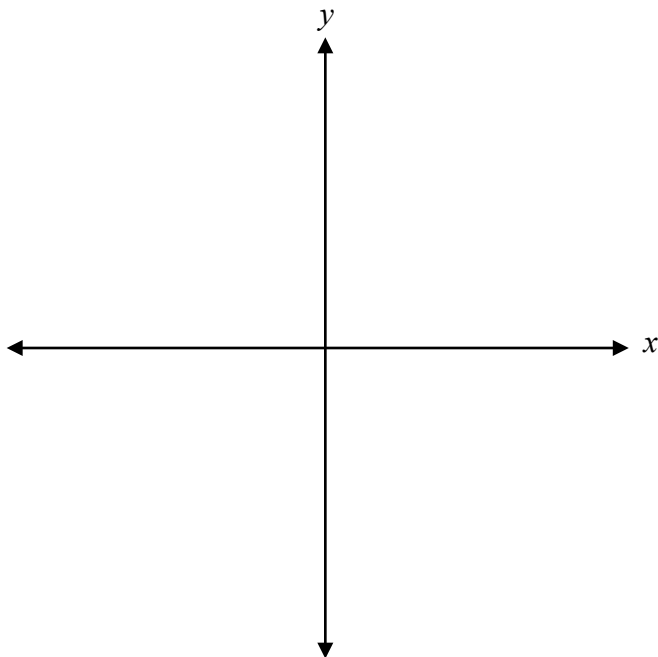
domain: _____

- b) Determine the x -intercept and y -intercept of $f(g(x))$.

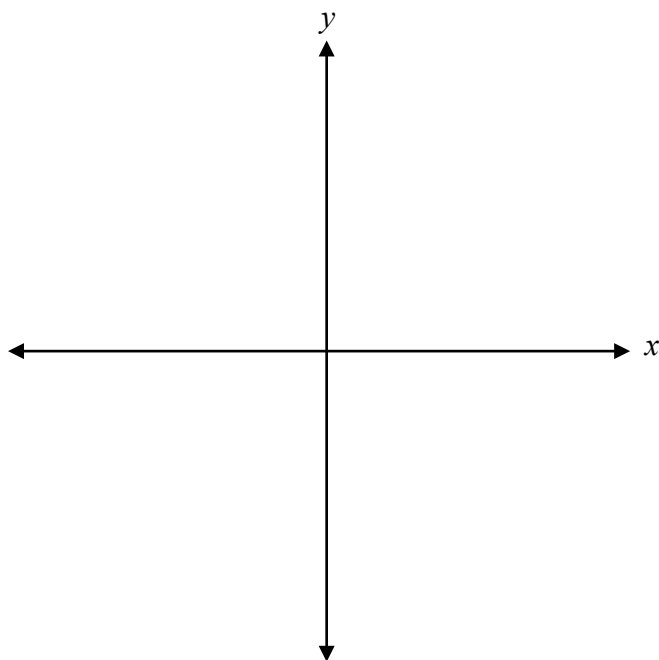
x -intercept: _____

y -intercept: _____

a) Sketch the graph of $f(x) = \log_5(x-1)$.



b) Sketch the graph of $f^{-1}(x)$.



Question 34

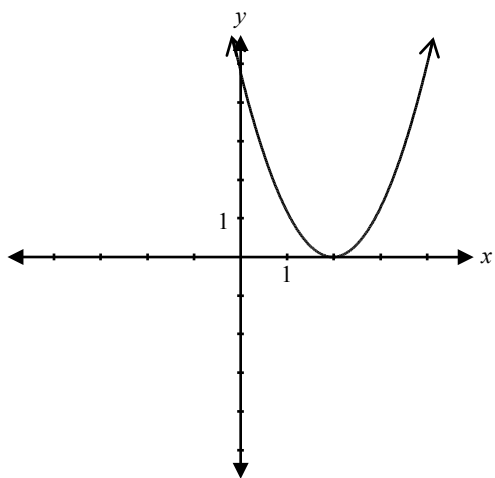
1 mark 129

Explain what the graph of a rational function looks like near a vertical asymptote.

Question 35

1 mark 130

Given the graph of $f(x) = (x - 2)^2$,



determine one possible restriction for the domain of $f(x)$ so that its inverse is a function.

Domain: _____

Question 36

2 marks 131

Over the interval $[0, 2\pi]$, determine the non-permissible values of θ in the expression $\csc \theta(\cos \theta + 1)$.

Question 37

1 mark 132

Explain why ${}_3C_8$ is undefined.

Solve:

$${}_n P_3 = 48(n - 1)$$

Question 39

a) 2 marks b) 1 mark c) 1 mark

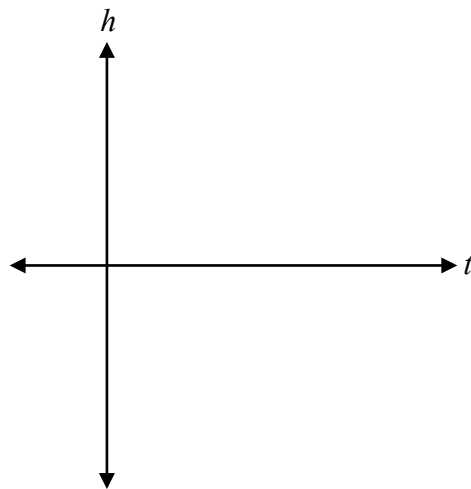
134
135
136

Christine dives off a diving board.

Her dive is modelled by the function $h(t) = t^3 - 3t^2 - t + 3$, where h is her height in metres, relative to the water surface and t is the time in seconds after diving off the diving board.

a) Given that $(t + 1)$ is a factor for the function $h(t)$, determine the other factors.

b) Sketch the graph of the function $h(t)$ for the time interval $t = 0$ to $t = 3$.



c) Determine how many seconds Christine is underwater.

Question 40

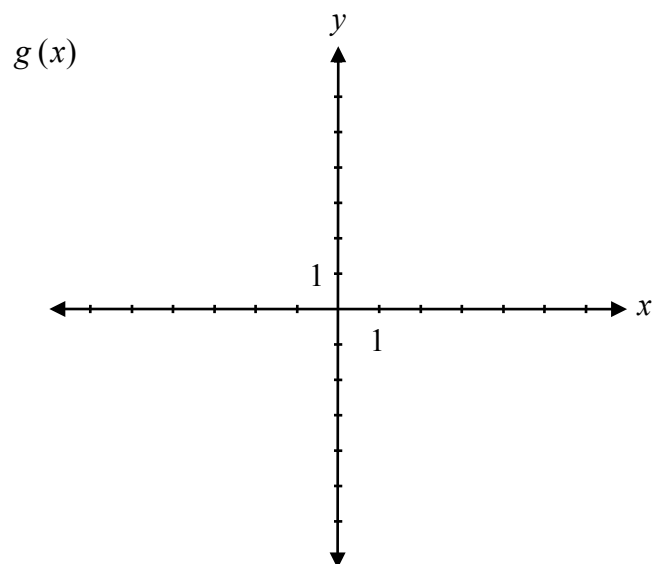
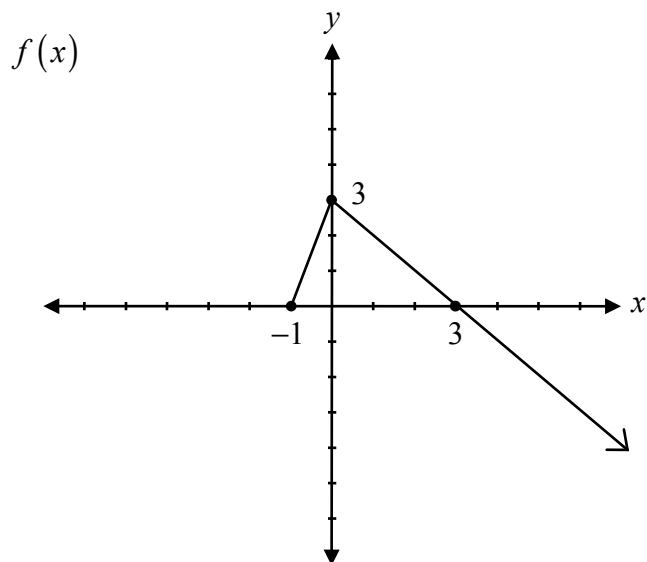
3 marks 137

Prove the identity for all permissible values of x .

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

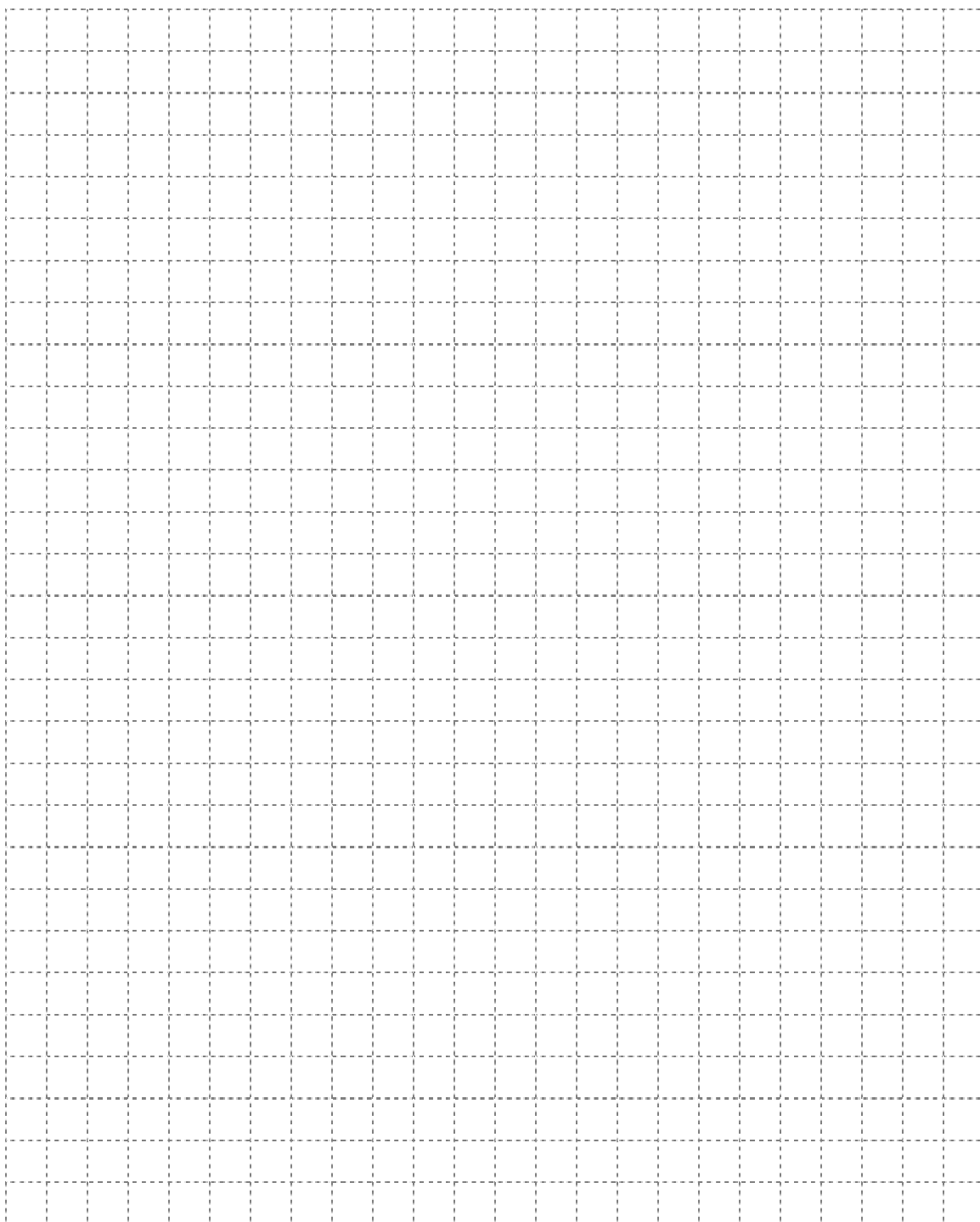
Left-Hand Side	Right-Hand Side

Given the graph of $f(x)$, sketch the graph of the function $g(x) = -|f(x)|$.

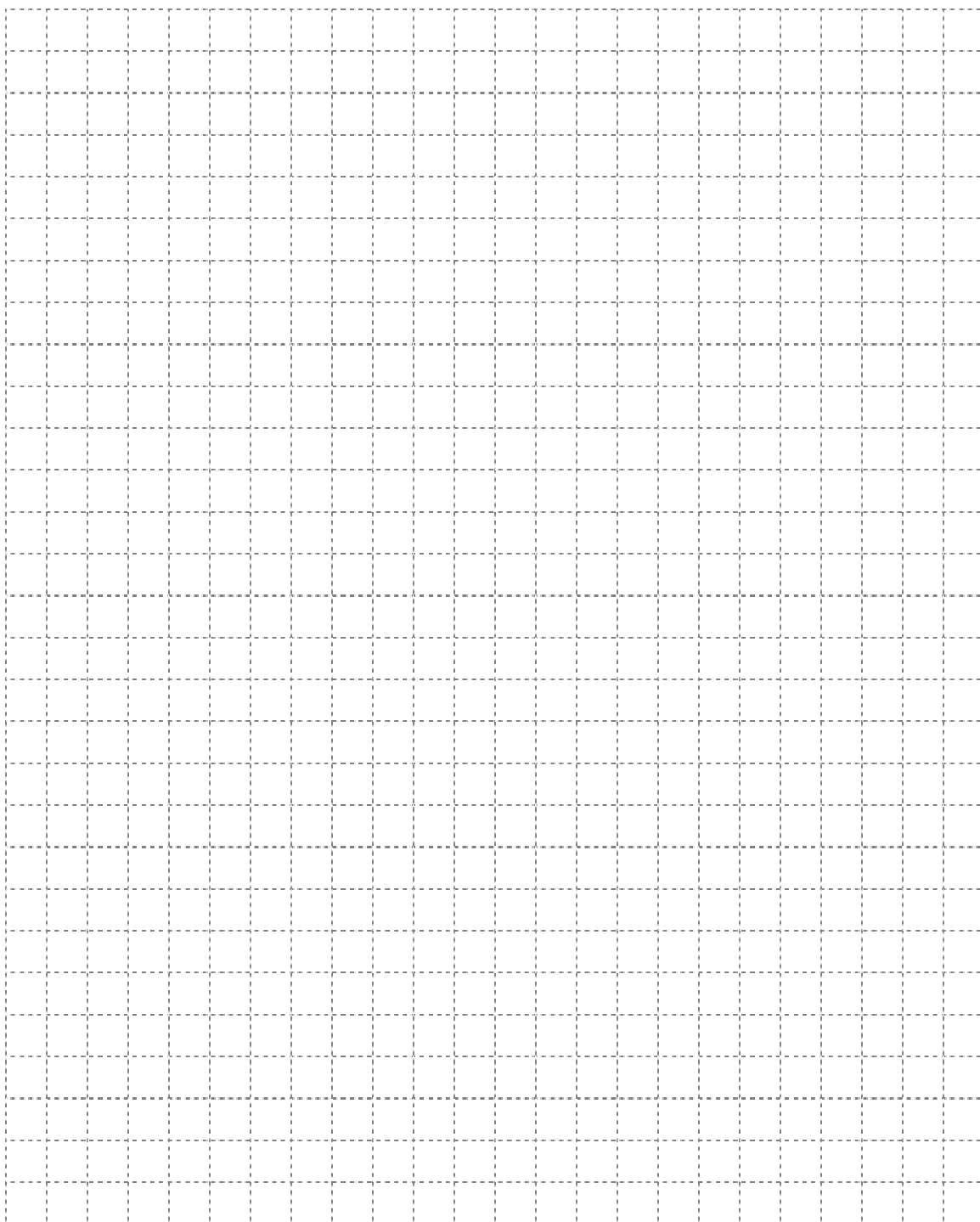


Given that $\cot \theta = -\frac{2}{5}$, where θ is in Quadrant IV, determine the exact value of $\sin \theta$.

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