Grade 12
Pre-Calculus Mathematics
Achievement Test

# Booklet 2

January 2019

Manitoba

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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 | 33 |
| **Booklet 2** | 10 | 22 | 57 |
| **Total** | 10 | 39 | **90** |

* 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. Please turn off your cell phone and all other such devices.**

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

## Question 18 — 1 mark

Identify the remainder when $P(x) = 3x^3 - x^2 + 1$ is divided by $(x - 2)$.

a) $-27$

b) $-19$

c) 11

d) 21

## Question 19 — 1 mark

Identify the logarithmic form of $2^x = \frac{1}{4}$.

a) $\log_2 x = \frac{1}{4}$

b) $\log_x 2 = \frac{1}{4}$

c) $\log_2\left(\frac{1}{4}\right) = x$

d) $\log_x\left(\frac{1}{4}\right) = 2$

## Question 20 — 1 mark

Leah's Pizzeria offers 9 different pizza toppings. Identify the expression that represents the number of different types of pizzas, with 3 different toppings, that can be made.

a) ${}_9C_3$

b) ${}_9P_3$

c) $\frac{9!}{3!}$

d) 9!3!

## Question 21 — 1 mark

Given $(5,-4)$ is a point on the graph of $y = f(x)$, identify the corresponding point on the graph of $y = \frac{1}{f(x)}$.

a) $\left(\frac{1}{5}, -4\right)$

b) $\left(5, -\frac{1}{4}\right)$

c) $\left(\frac{1}{5}, -\frac{1}{4}\right)$

d) $(-4, 5)$

## Question 22 — 1 mark

Identify the non-permissible value of $x$ for $1 + \sec x$ over $[0, \pi]$.

a) 0

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

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

d) $\pi$

## Question 23 — 1 mark

Indicate the combination that represents the circled term in the given row of Pascal's triangle.

1 4 6 (4) 1

a) ${}_4C_3$

b) ${}_4C_4$

c) ${}_5C_3$

d) ${}_5C_4$

## Question 24 — 1 mark

Identify the $x$-intercept on the graph of $f(x) = \sqrt{2(x+5)}$.

a) $-5$

b) $0$

c) $\sqrt{10}$

d) $5$

## Question 25 — 1 mark

Identify the coterminal angle of $\frac{\pi}{5}$ over the interval $-\pi \le \theta \le 4\pi$.

a) $-\frac{9\pi}{5}$

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

c) $\frac{3\pi}{5}$

d) $\frac{11\pi}{5}$

## Question 26 — 1 mark

Given $f(x) = \{(2,6),(3,2),(3,4),(6,5)\}$, identify the value of $f(f(2))$.

a) 3

b) 4

c) 5

d) 6

## Question 27 — 1 mark

The graph of $f(x) = (x-1)^2$ is translated 2 units to the left and 3 units up. Identify the equation of the transformed graph, $g(x)$.

a) $g(x) = (x+1)^2 + 3$

b) $g(x) = (x-3)^2 + 3$

c) $g(x) = (x+2)^2 + 3$

d) $g(x) = (x-2)^2 + 3$

## Question 28 — 2 marks — 119

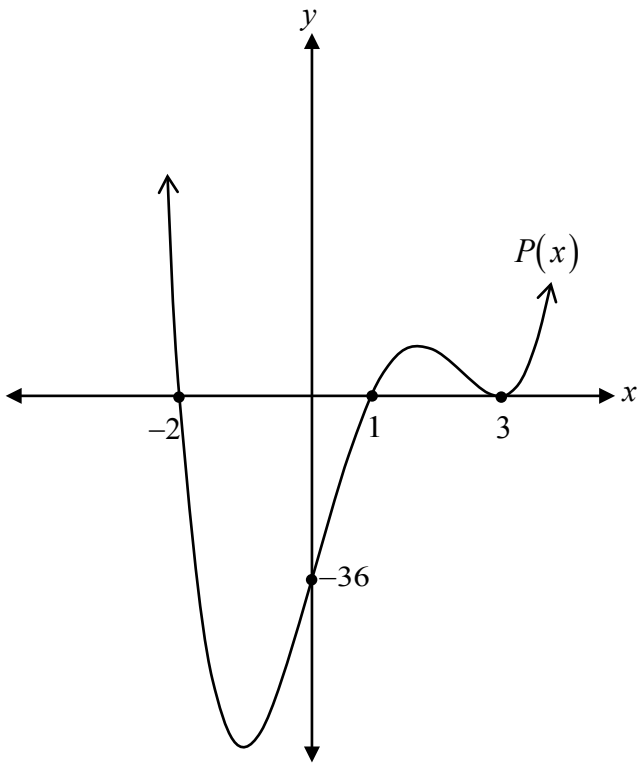
Given $\csc\theta = -\frac{8}{5}$, determine the exact value of $\cos 2\theta$.

## Question 29 — 1 mark — 120

Determine the period of the sinusoidal function, $f(x) = -6\cos\left(\frac{\pi}{6}(x+1)\right) + 5$.

## Question 30 — 2 marks — 121

Determine, algebraically, the equation of $P(x)$, given the graph of the polynomial function $P(x)$.




$P(x) =$ _____

## Question 31 — 4 marks — 122

Solve $2\sin^2\theta - 7\sin\theta - 4 = 0$ where $\theta \in \mathbb{R}$.

## Question 32 — 1 mark — 123

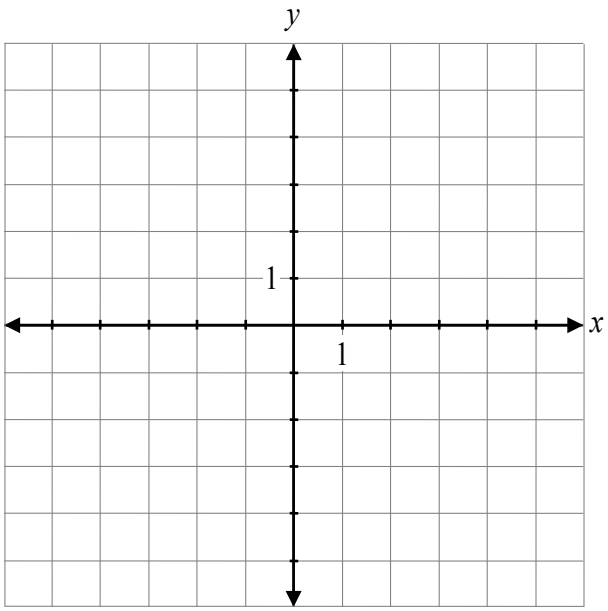
Justify that the shapes of the graphs of $f(x) = (x+1)^2(x-1)$ and $g(x) = (x+1)^2(x-1)^3$ are different as they approach the $x$-intercept at $x = 1$.

## Question 33 — 2 marks — 124

Determine the exact value of $\cot\theta$ if $\cos\theta = -\frac{4}{7}$ and $\sin\theta$ is positive.

## Question 34 — 3 marks — 125

Sketch the graph of $f(x) = -\log_2(x) + 2$.



## Question 35 — 1 mark — 126

State the range of $f(x) = \sqrt{x+4}$.

Range: _____

## Question 36

1 mark 127

Sophie correctly solved the logarithmic equation, $\log_7(x-1) = \log_7(2x-2)$.

$x - 1 = 2x - 2$

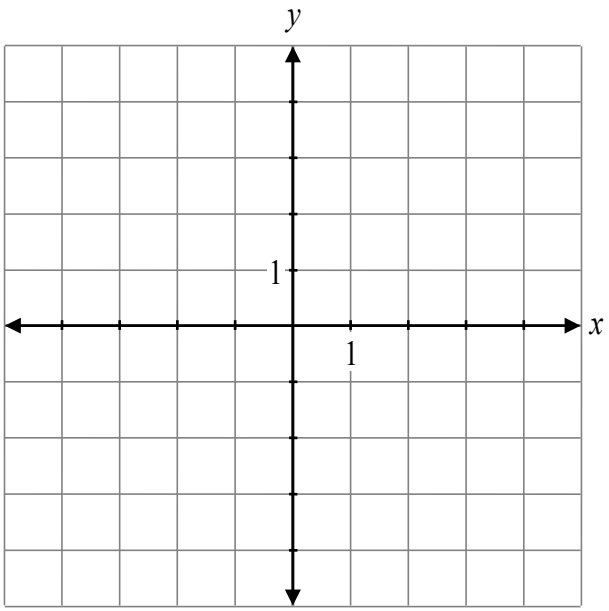
$-1 + 2 = 2x - x$

$1 = x$

Explain why $x = 1$ is an extraneous root.

## Question 37 — 3 marks — 128

Sketch the graph of $f(x) = \sqrt{4x} - 1$.



## Question 38 — 3 marks — 129

Solve, algebraically.

$${}_nC_2 = 2n + 7$$

## Question 39 — 1 mark — 130

Given $f(x) = x^2 - 1$ and $g(x) = x - 3,$ explain why the domain of $h(x) = \dfrac{f(x)}{g(x)}$ has a restriction when $x = 3.$

## Question 40 — 3 marks — 131

Evaluate.

$$\frac{\cot\left(\frac{11\pi}{6}\right)\sin\left(-\frac{4\pi}{3}\right)}{\cos\left(\frac{2\pi}{3}\right)}$$

## Question 41 — 1 mark — 132

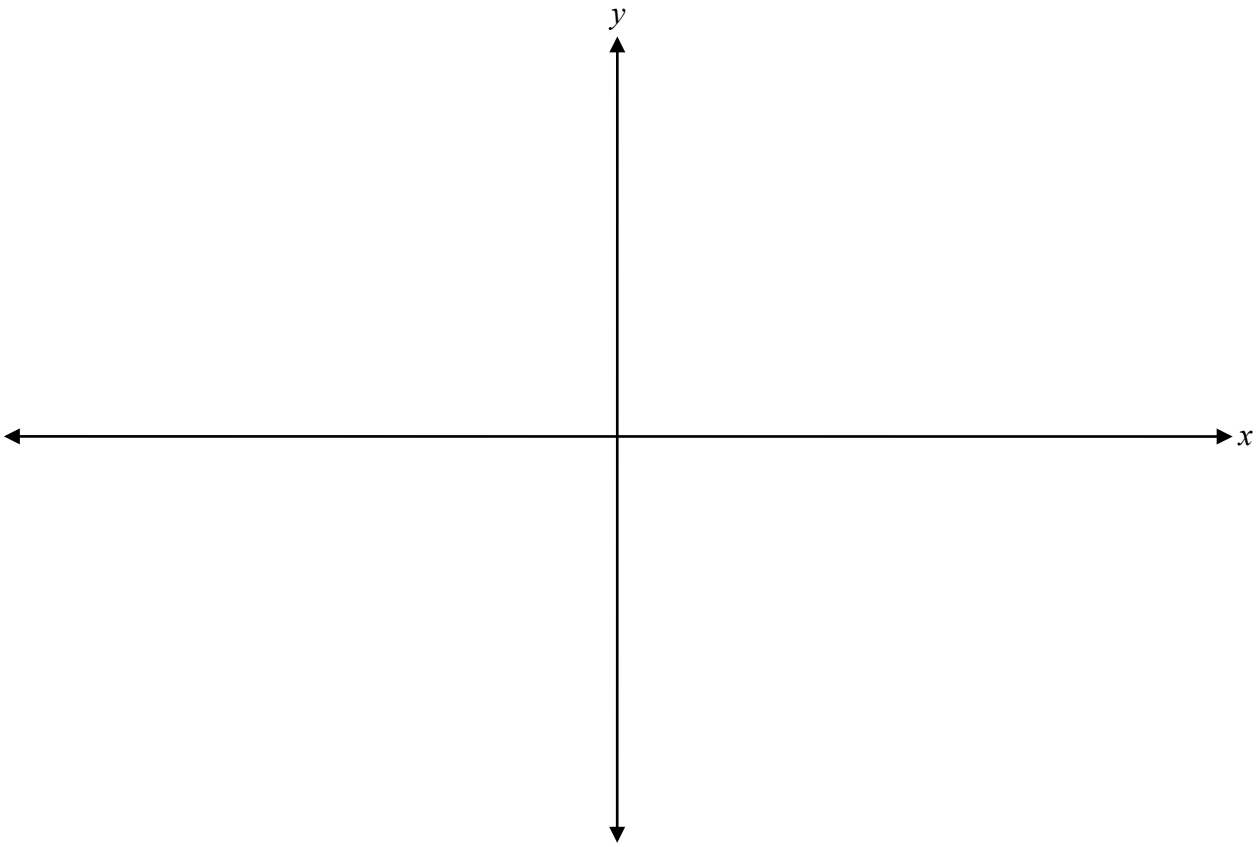
Solve, algebraically.

$$\log_2\left(\log_3 x\right) = 2$$

## Question 42

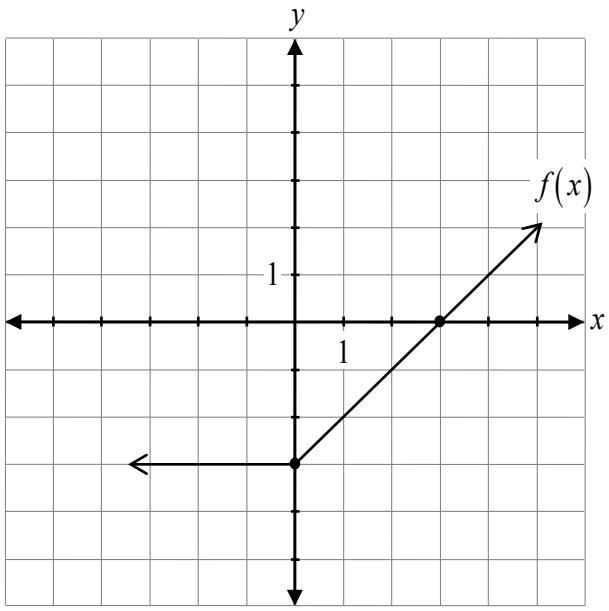
4 marks 133

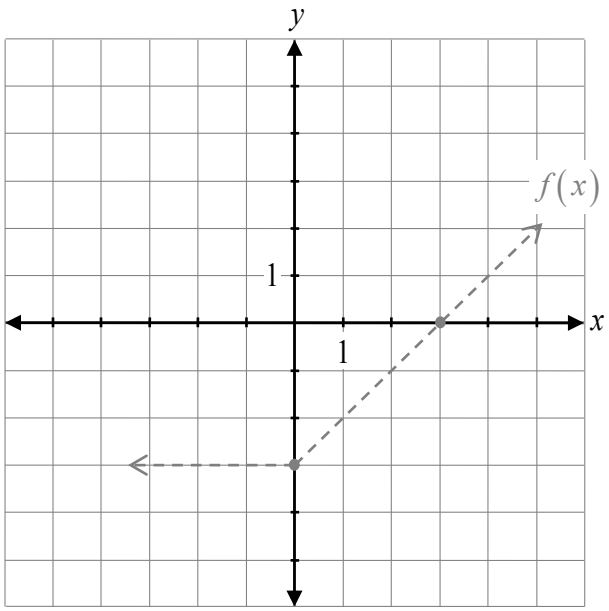
Sketch the graph of the function $y = 5\sin\left(\frac{\pi}{4}x\right) + 1$ over the domain $[-4, 8]$.



## Question 43 — 2 marks — 134

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



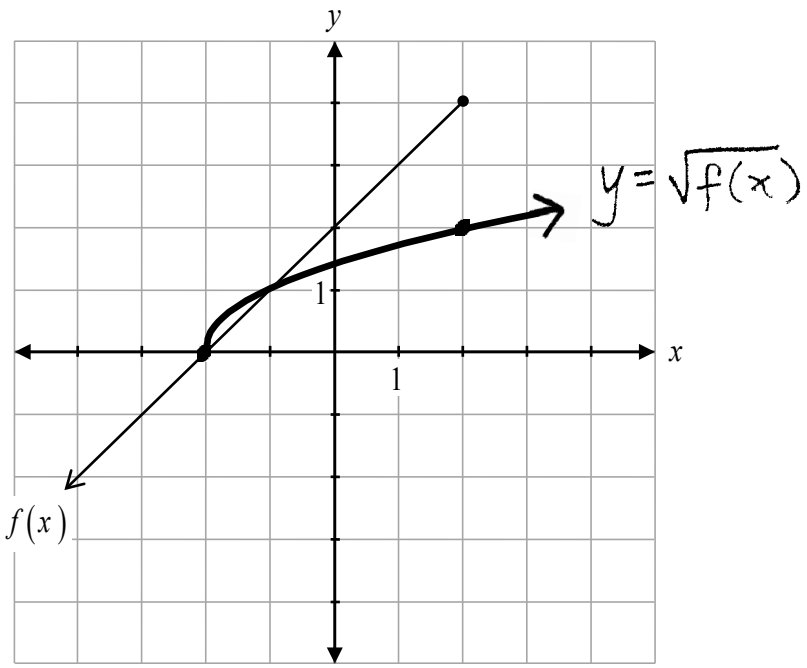




The graph of $f(x)$ has already been drawn for your reference.

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

## Question 44 — 1 mark — 135

Savannah used the graph of $y = f(x)$ to sketch the graph of $y = \sqrt{f(x)}$. Her solution is given below. Describe her error.



## Question 45 — 3 marks — 136

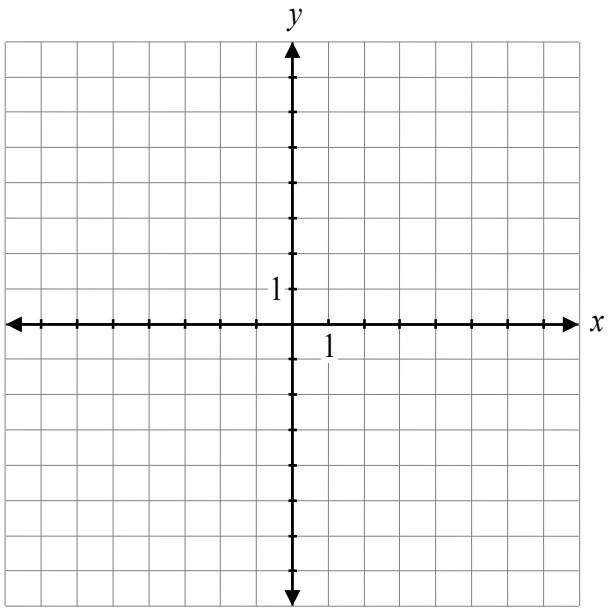
Determine the exact value of $\sin\left(\frac{13\pi}{12}\right)$.

## Question 46 — 1 mark — 137

State the equation of the horizontal asymptote of $f(x) = \dfrac{3x}{x-1}$.

## Question 47 — 4 marks — 138

Sketch the graph of $f(x) = \dfrac{5x - 10}{x^2 + x - 6}$.

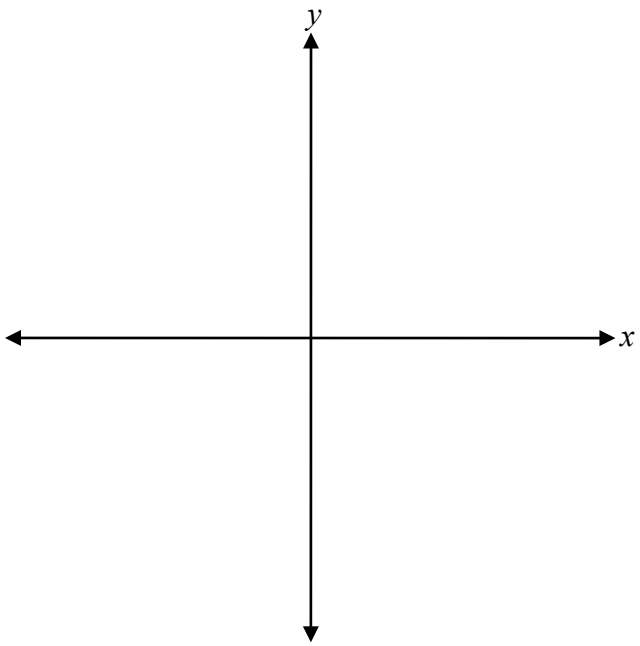
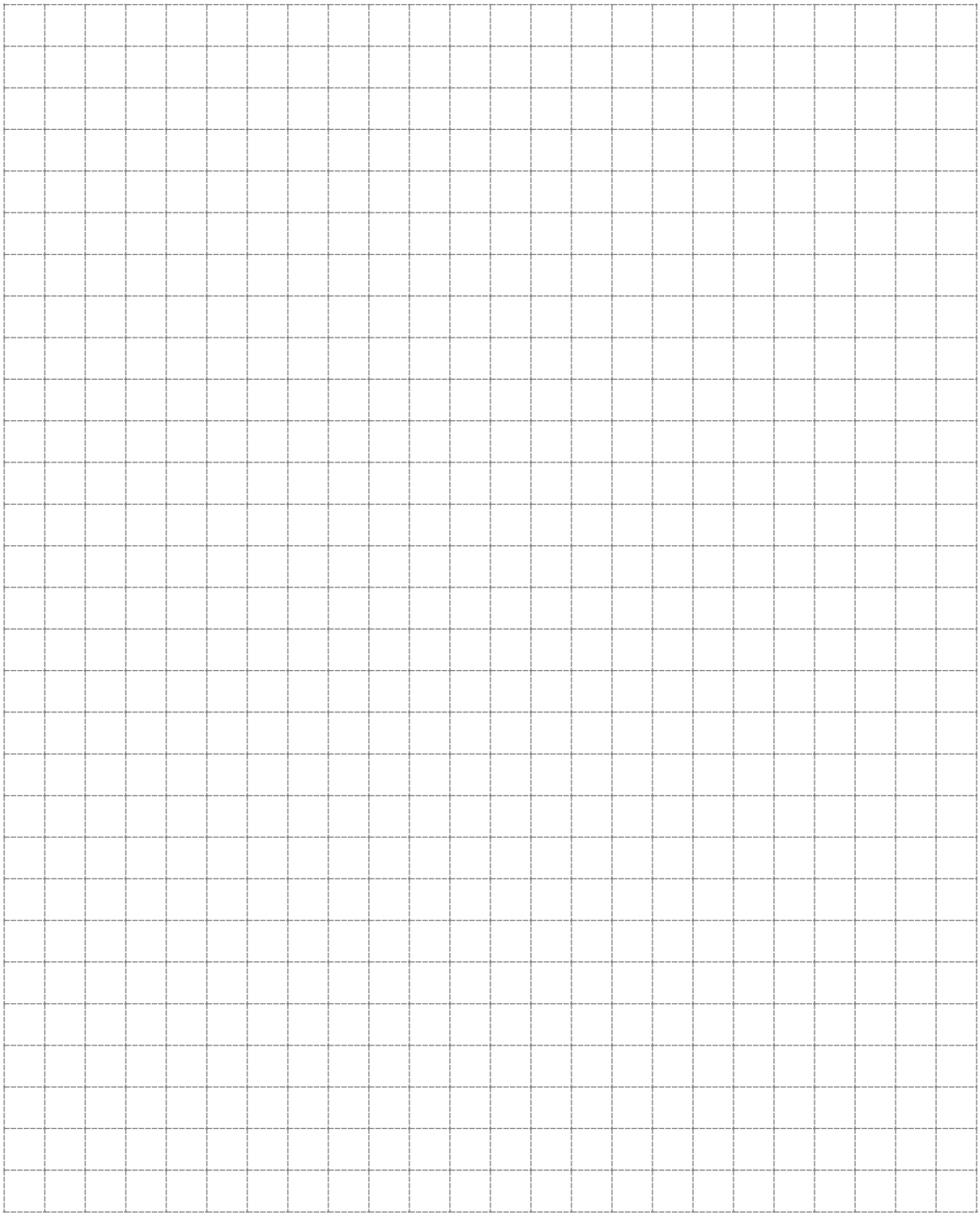


## Question 48 — 2 marks — 139

Determine, algebraically, the inverse of $f(x) = 3x + 4$.

## Question 49 — 2 marks — 140

Sketch the graph of $P(x) = -(x+1)(x-2)(x+3)$.



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