Grade 12
Pre-Calculus Mathematics
Achievement Test

Booklet 1

June 2025

Manitoba

Grade 12 pre-calculus mathematics achievement test.
Booklet 1. June 2025

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Manitoba Education and Early Childhood Learning
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Available in alternate formats upon request.

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**

* The first 4 questions with the symbol  in Booklet 1 require a scientific calculator. You will have access to your calculator for the first 45 minutes of the test.

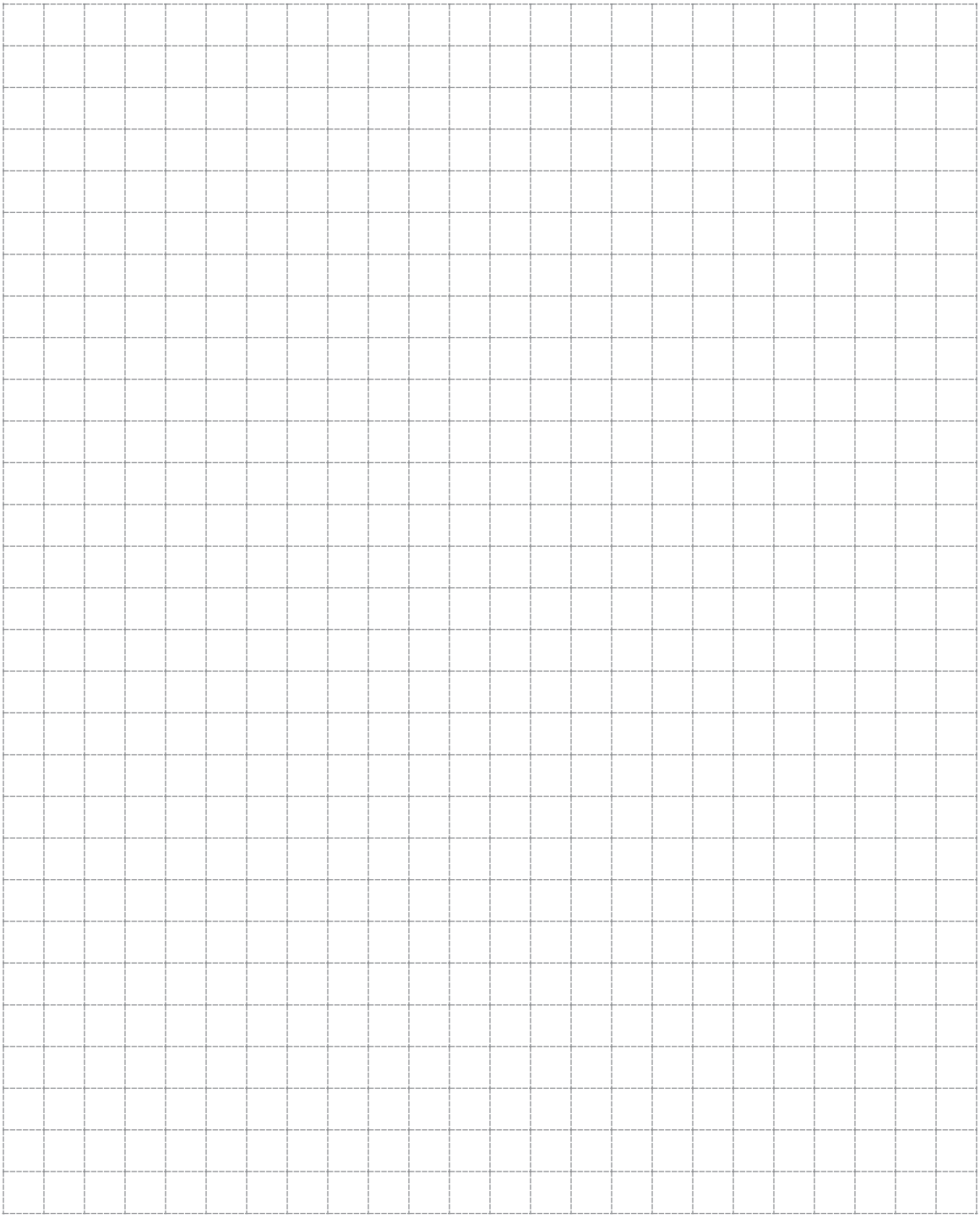
Note that diagrams and graphs provided in the test booklets may not be drawn to scale.

DIRECTIONS

- Write each solution in the space provided.
- For full marks, your answers must show all pertinent diagrams, calculations, and explanations.
- Your solutions should be neat, organized, and clear.
- Some answers are to be given as decimal values. Rounding too early in your solution may result in an inaccurate final answer for which full marks will not be given.
- Express your answers as exact values or correct to the nearest thousandth (3 decimal places) unless instructed otherwise.

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.



Formula Sheet

$$s = \theta r$$

$$\sin^2\theta + \cos^2\theta = 1$$

$$\tan^2\theta + 1 = \sec^2\theta$$

$$1 + \cot^2\theta = \csc^2\theta$$

$$\sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$$

$$\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$$

$$\tan(\alpha - \beta) = \frac{\tan\alpha - \tan\beta}{1 + \tan\alpha\tan\beta}$$

$$\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$$

$$\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$$

$$\tan(\alpha + \beta) = \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta}$$

$$\sin 2\alpha = 2\sin\alpha\cos\alpha$$

$$\cos 2\alpha = \cos^2\alpha - \sin^2\alpha$$

$$\cos 2\alpha = 1 - 2\sin^2\alpha$$

$$\cos 2\alpha = 2\cos^2\alpha - 1$$

$$\tan 2\alpha = \frac{2\tan\alpha}{1 - \tan^2\alpha}$$

$$\log_a(MN) = \log_a M + \log_a N$$

$$\log_a\left(\frac{M}{N}\right) = \log_a M - \log_a N$$

$$\log_a\left(M^n\right) = n\log_a M$$

$$P(n,r) \text{ or } {}_nP_r = \frac{n!}{(n-r)!}$$

$$C(n,r) \text{ or } {}_nC_r = \frac{n!}{r!(n-r)!}$$

$$t_{k+1} = {}_nC_k a^{n-k} b^k$$

Given $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Terminology Sheet

Some questions may contain directing words such as *explain, identify, and justify*.
These words are defined below.

Describe: Use words to provide the process or to report details of the response.

Determine: Use a mathematical formula, an algebraic equation, or a numerical calculation to solve a problem.

Evaluate: Find the numerical value.

Explain: Use words to provide the cause of or reason for the response, or to render the response more clear and understandable.

Identify: Recognize and select the answer by stating or circling it.

Justify: Show reasons for or give facts that support a position by using mathematical computations, words, and/or diagrams.

Sketch the graph: Provide a detailed drawing with key features of the graph that includes a minimum of two coordinate points.

Solve: Give a solution for a problem or determine the value(s) of a variable.

State: Give an answer without an explanation or justification.

Verify: Establish the truth of a statement by substitution or comparison.

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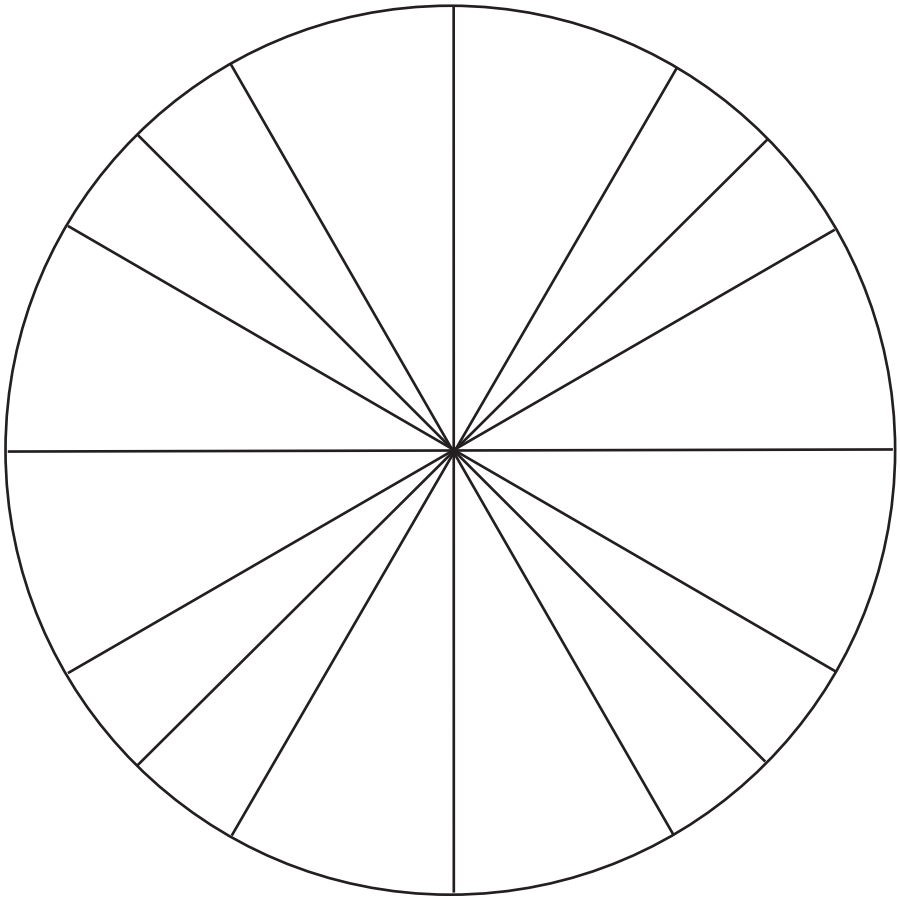

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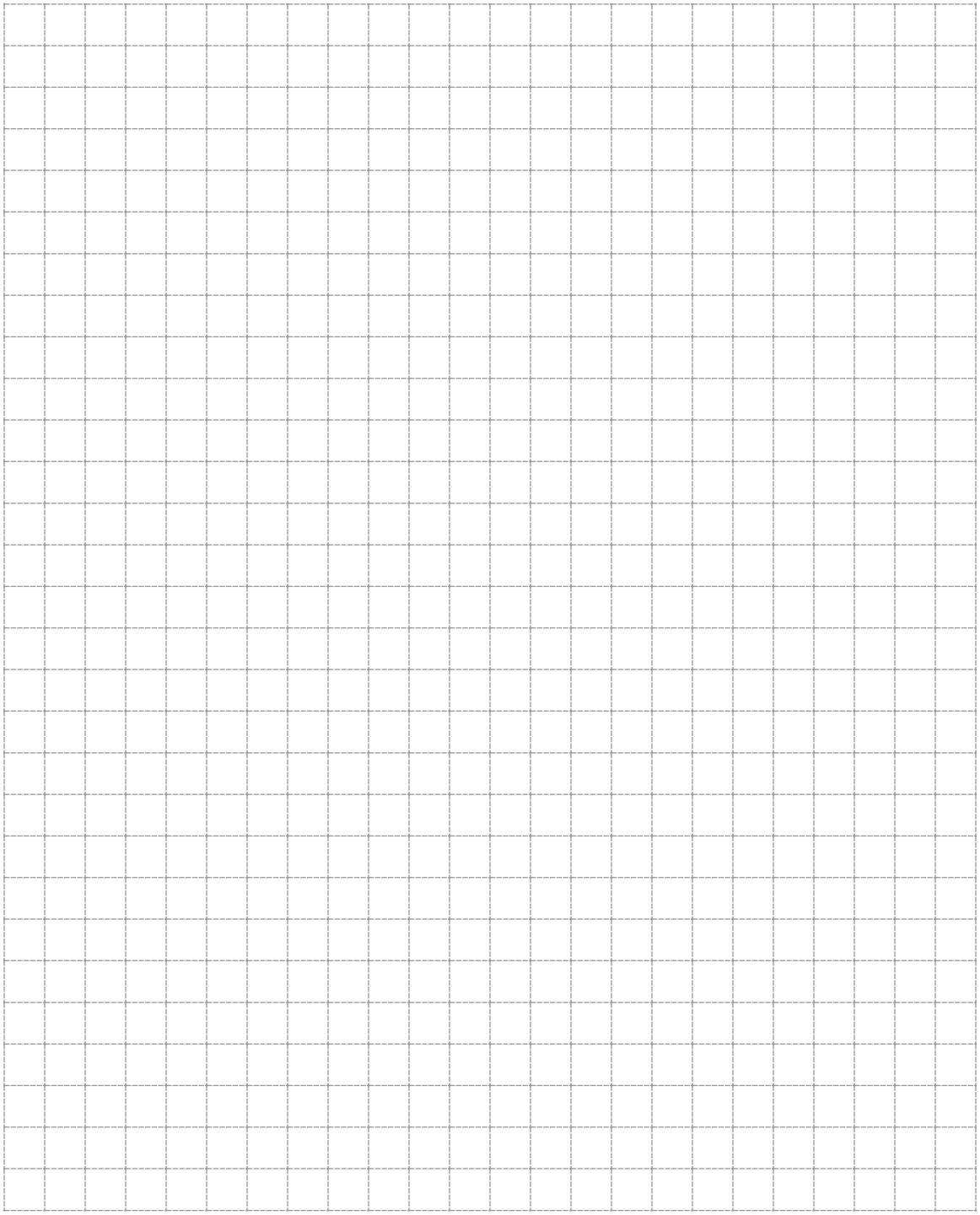


Question 1  **1 mark** 101

Manitoba postal codes consist of three letters and three digits. Determine the total number of possible postal codes in Manitoba if the following characteristics must be met:

- The postal code must begin with the letter R.
- Only 18 letters of the alphabet can be used.
- The letters and digits must alternate.
- The letters and digits can be repeated.

Question 2  2 marks 102

The percent of people who click on a link, in response to seeing an advertisement on YouTube, can be modeled by the formula:

$$R(t) = -(0.8)^{0.2t} + 0.6$$

where $R(t)$ is the percentage, in decimal form, of people who click on the link

t is the time in days.

Determine, algebraically, the number of days it will take for 45% of people who see the advertisement to click on the link.

Question 3  **3 marks** 103

Determine and simplify the middle term in the binomial expansion of $\left(\frac{5}{x}+4x^3\right)^6$.

Question 4  3 marks

104

Solve $3\tan^2 x + 5\tan x - 6 = 0$, over the interval $[0, 2\pi]$.

Note: A calculator is not required for the remaining test questions.

Question 5 — a) 1 mark b) 1 mark

105
106

Given $\theta = -80^\circ$,

a) determine the measure of θ, in radians.

b) state all the coterminal angles of θ.

Question 6 — 1 mark

107

State a possible value of n if the polynomial function $p(x)=(x+1)^n(x-4)^2$ has a range of $(-\infty,\infty)$.

Question 7 — 4 marks

108

Describe the transformations used to obtain the graph of the function $y = -2f\left(x + 8\right) - 5$ from the graph of $y = f\left(x\right)$.

Question 8 — 2 marks

109

State the domain and range of the function $f(x) = \frac{-2}{x^2}$.

Domain: _____

Range: _____

Question 9 — 1 mark — 110

Given the following row of Pascal's Triangle, state the values in the next row.

1 5 10 10 5 1

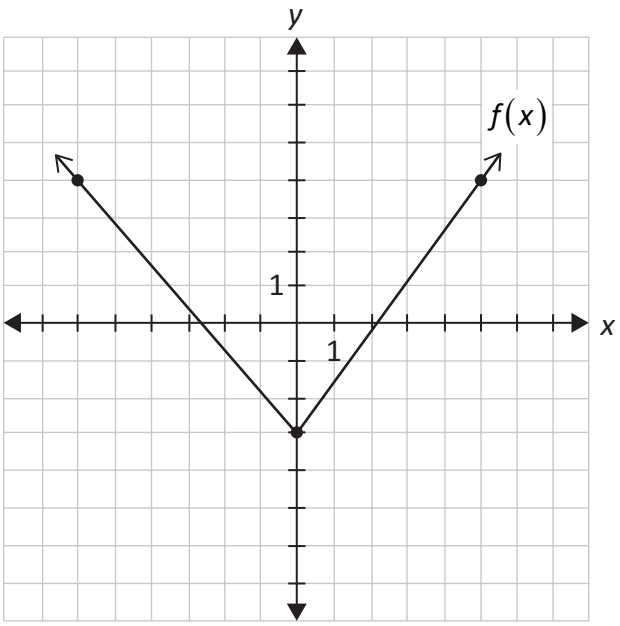
Question 10 — 2 marks — 111

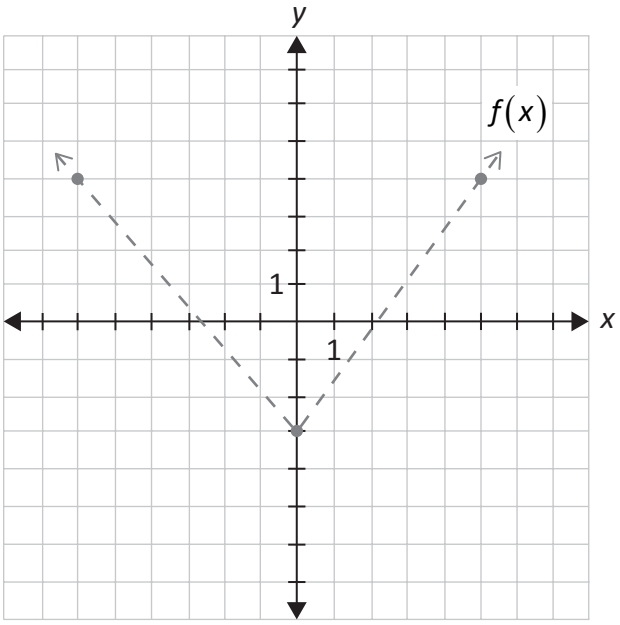
Given $f(x) = 3 - 2x$, determine the equation of $f^{-1}(x)$.

Question 11 — 2 marks

112

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





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

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

Question 12 — 3 marks — 113

Prove the identity for all permissible values of x.

$$\frac{\csc^2 x + \sec^2 x}{\tan x + \cot x} = \csc x \sec x$$

Left-Hand Side	Right-Hand Side

Question 13 — 1 mark

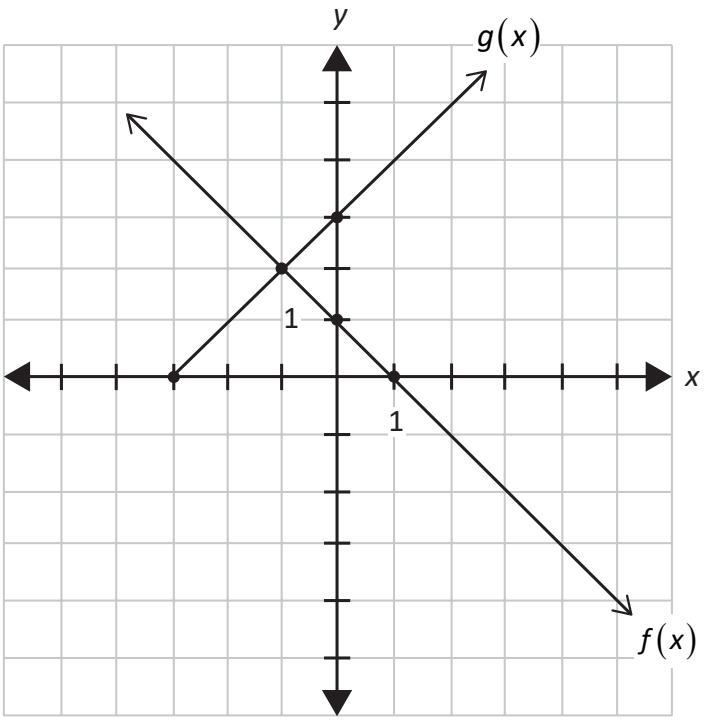
114

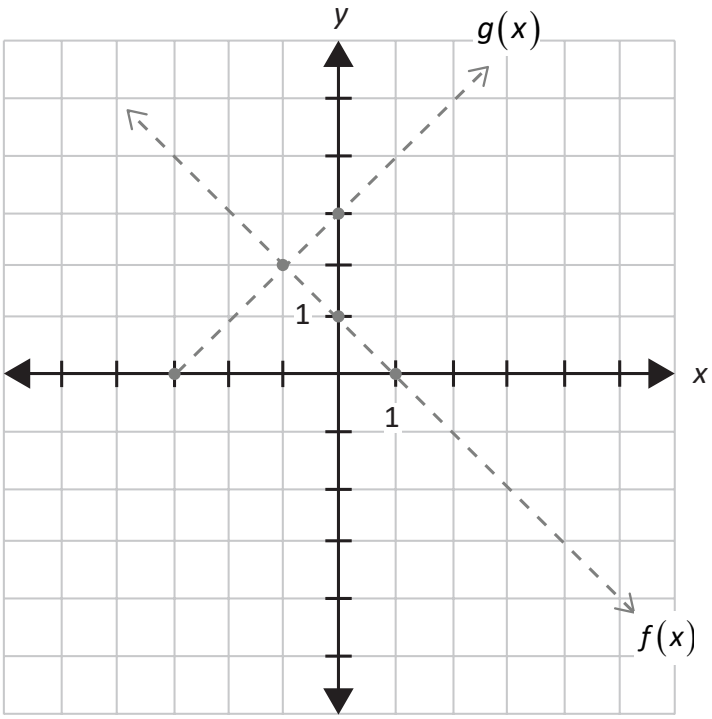
Justify that the graph of $f(x) = e^{x+1} + 5$ does not have an x-intercept.

Question 14 — 2 marks

115

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





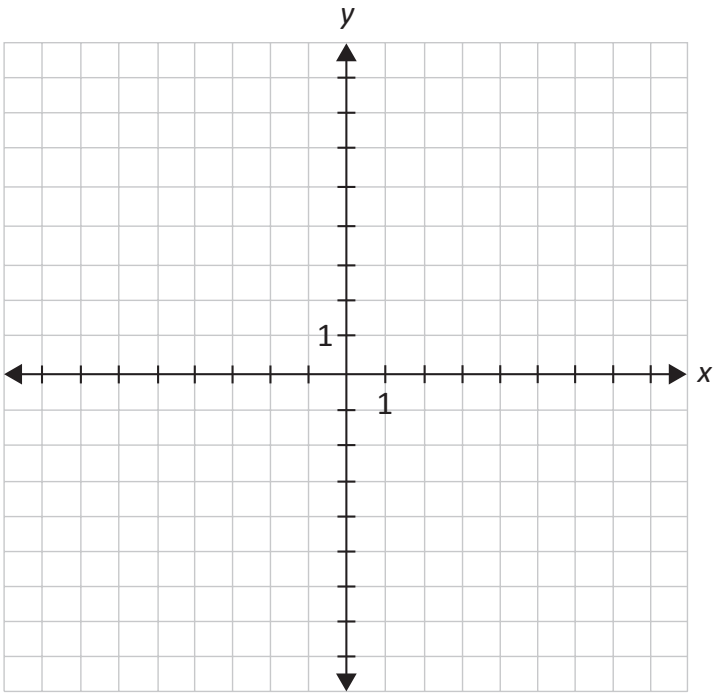
The graph of $f(x)$ and $g(x)$ have already been drawn for your reference.

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

Question 15 — 4 marks

116

Sketch the graph of $f(x) = \frac{5}{2}\sqrt{-(x-4)}$.



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