Grade 12
Pre-Calculus Mathematics
Achievement Test

Booklet 2

January 2017

Manitoba

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After the administration of this test, print copies of this resource will be available for purchase from the Manitoba Learning Resource Centre (formerly the Manitoba Text Book Bureau). Order online at www.mtbb.mb.ca.

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Disponible en français.

Available in alternate formats upon request.

Instructions

Selected Response Questions

- There are 9 questions worth a total of 10 marks.
- 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 19 questions worth a total of 43 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 19 — 1 mark

Identify the trigonometric function that is equivalent to $\sin\frac{\pi}{4}\cos\frac{\pi}{3}+\cos\frac{\pi}{4}\sin\frac{\pi}{3}$.

a) $\sin\frac{2\pi}{7}$

b) $\sin\frac{7\pi}{12}$

c) $\cos\frac{2\pi}{7}$

d) $\cos\frac{7\pi}{12}$

Question 20 — 1 mark

Identify the logarithmic form of $5^x = 6$.

a) $\log_5 x = 6$

b) $\log_5 6 = x$

c) $\log_6 x = 5$

d) $\log_6 5 = x$

Question 21 — 1 mark

Given $f(\theta) = 3\cos 2\theta - 1$ and $g(\theta) = \sin\theta + 1,$ identify which statement is true.

a) Both functions have the same period.

b) Both functions have the same amplitude.

c) Both functions have the same minimum value.

d) Both functions have the same maximum value.

Question 22 — 1 mark

Identify the fourth term in the expansion of $(x + y)^5$.

a) $10x^4y$

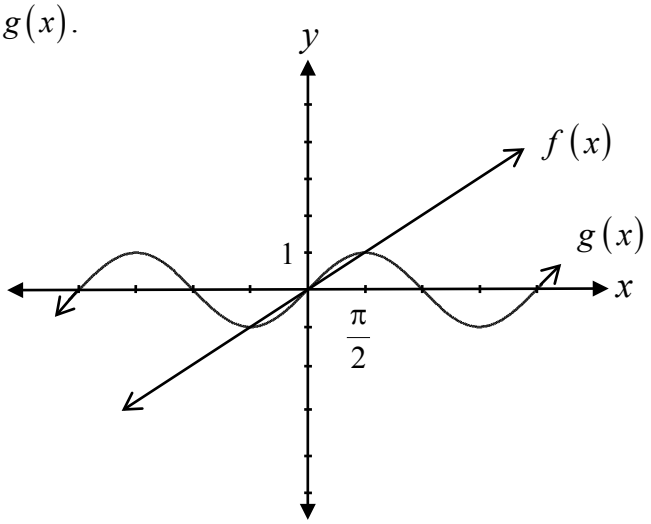
b) $10x^3y^2$

c) $10x^2y^3$

d) $10xy^4$

Question 23 — 1 mark

Given the graphs of $f(x)$ and $g(x)$, identify the choice with all of the solutions of the equation $f(x) = g(x)$.



a) $x = -2\pi,\ -\pi,\ 0,\ \pi,\ 2\pi$

b) $x = -\frac{\pi}{2},\ 0,\ \frac{\pi}{2}$

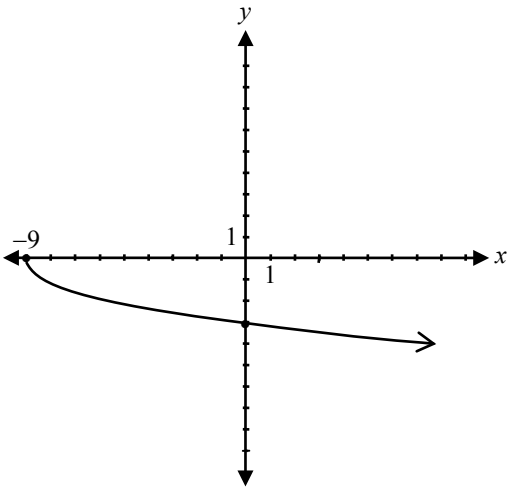
c) $x = \frac{\pi}{2}$

d) $x = -1,\ 0,\ 1$

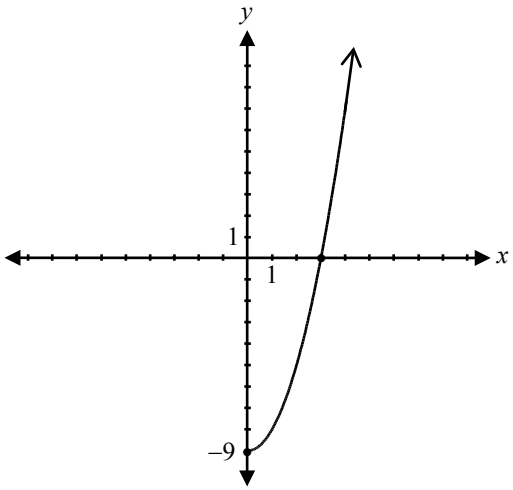
Question 24 — 1 mark

Identify the graph of $f^{-1}(x)$ if $f(x) = x^2 - 9, x \geq 0$.

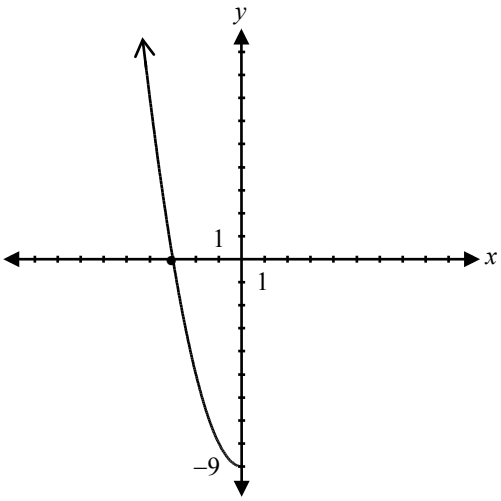
a)



b)



c)



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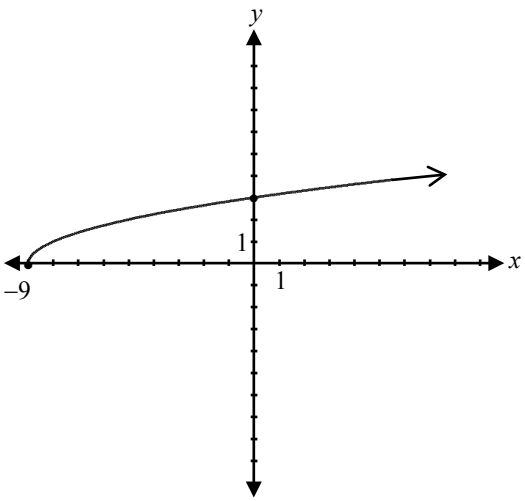


Question 25 — 1 mark

Using the remainder theorem, identify which value of x results in a remainder of zero given $p(x) = x^3 + 7x^2 + 14x + 8.$

a) 1

b) 0

c) -1

d) -3

Question 26 — 1 mark

Evaluate $\cos\left(\cos\left(\frac{3\pi}{2}\right)\right)$.

a) 1

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

c) 0

d) -1

Question 27 — 2 marks

Match the following equations with their graphs:

Place the appropriate letter in this column.

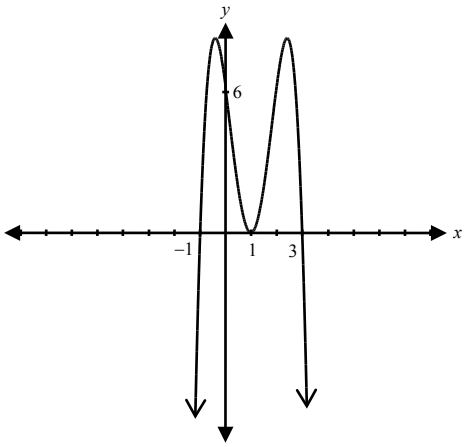
$f(x) = (x-1)^3(x+1)(x-3)$ _____

$g(x) = (x+1)^2(x-1)(x+3)$ _____

$h(x) = -2(x-1)^2(x+1)(x-3)$ _____

$k(x) = 2(x+1)^2(x-1)(x+3)$ _____

A)



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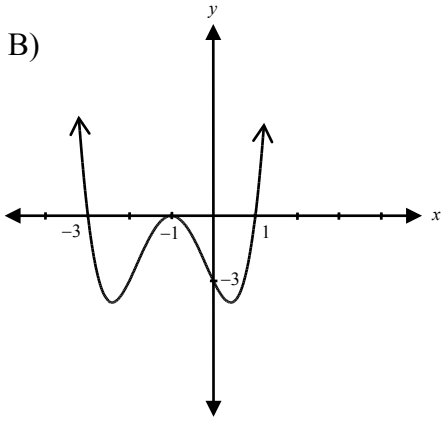

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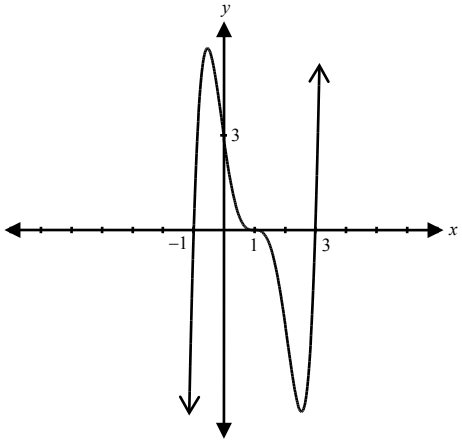

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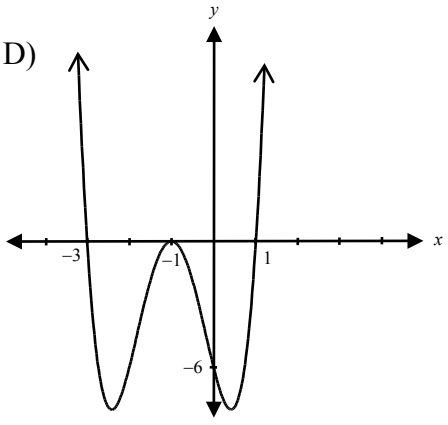
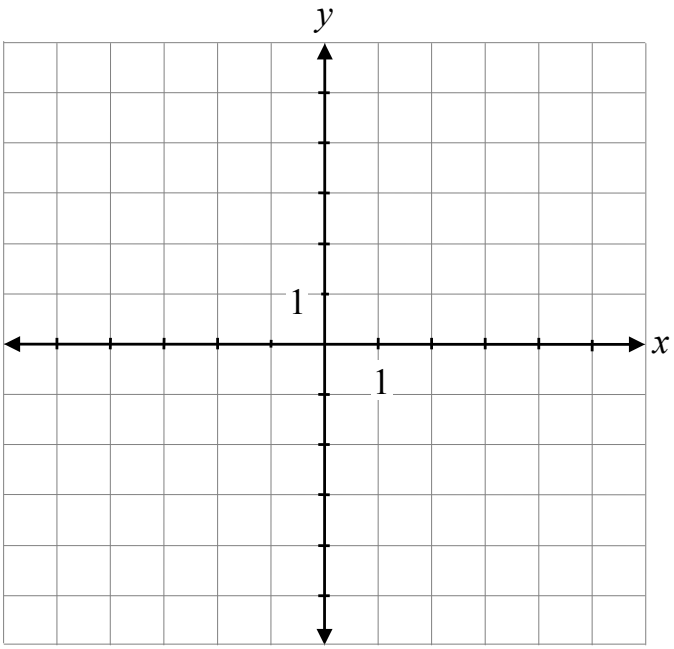


Question 28 — 2 marks — 122

If $\log 6 = p$, $\log 5 = r$ and $\log 2 = q$, express $\log 60$ in terms of p, q and r.

Question 29 — 4 marks — 123

Sketch the graph of $y = \sqrt{-2x} + 1$.



Question 30 — 1 mark — 124

Justify why the letters of the word FRANCE have a greater number of possible arrangements than the letters of the word CANADA.

Question 31

a) 1 mark b) 3 marks

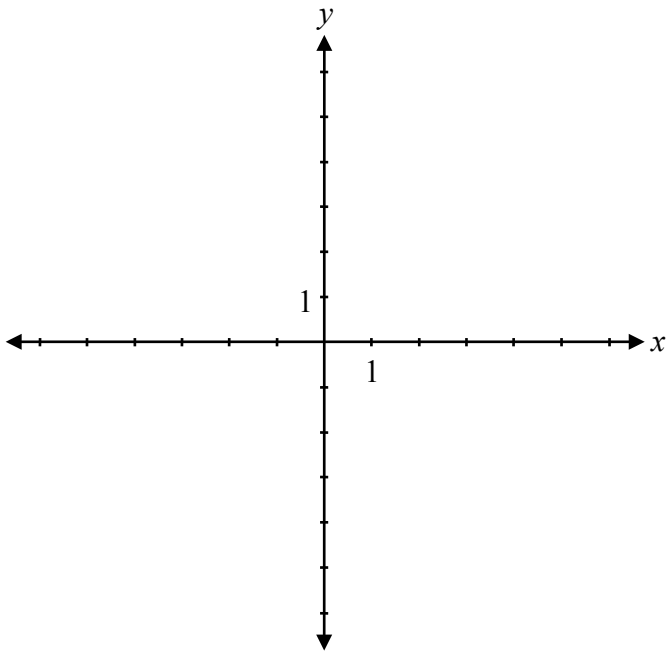
125
126

Given $f(x) = \dfrac{1}{x-2}$ and $g(x) = x + 5$,

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

$f(g(x))$=_____

b) sketch the graph of $f(g(x))$.



Question 32 — a) 3 marks b) 1 mark

127
128

Given that $\sin\alpha = \frac{3}{7}$, where α is in Quadrant II, and $\cos\beta = \frac{4}{5}$, where β is in Quadrant IV, determine the exact value of:

a) $\sin(\alpha - \beta)$

b) $\cos 2\alpha$

Question 33 — 2 marks — 129

Determine the domain and range of $f(x) = \sqrt{x-5} - 1$.

Domain: _____

Range:_____

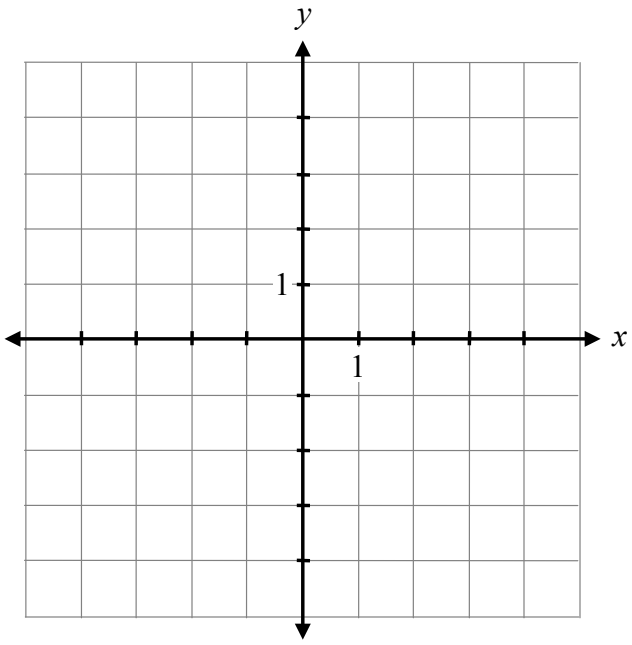
Question 34 — 1 mark — 130

Justify why 4.7 is a better estimate than 4.3 for the value of $\log_2 26$.

Question 35 — 2 marks — 131

Sketch the graph of the function:

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



Question 36 — 3 marks — 132

Evaluate:

$$\sec^2\left(\frac{\pi}{6}\right) + \tan\left(\frac{7\pi}{6}\right)\csc\left(-\frac{2\pi}{3}\right)$$

Question 37 — 1 mark — 133

The graph of $f(x) = 3x + 7$ is reflected over the y-axis.

Determine the equation of the new function.

$y =$ _____

Question 38 — 2 marks — 134

Determine the equations of all of the asymptotes of the function:

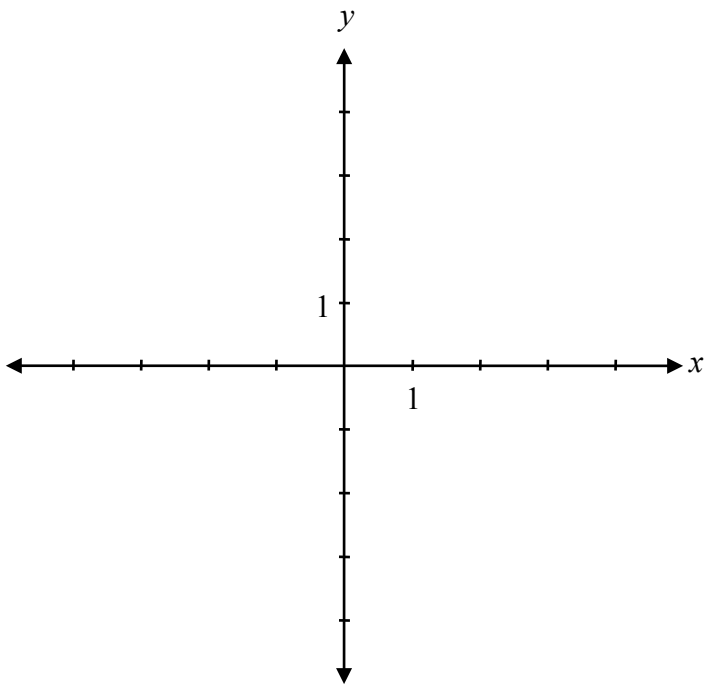
$$y = \frac{2x+1}{x-3}$$

Question 39 — 2 marks — 135

One of the zeros of $p(x) = x^3 + 6x^2 - 32$ is $x = 2$. Determine all of the other zeros of $p(x)$.

Question 40 — 3 marks — 136

Sketch the graph of $y = -2^x + 2$.

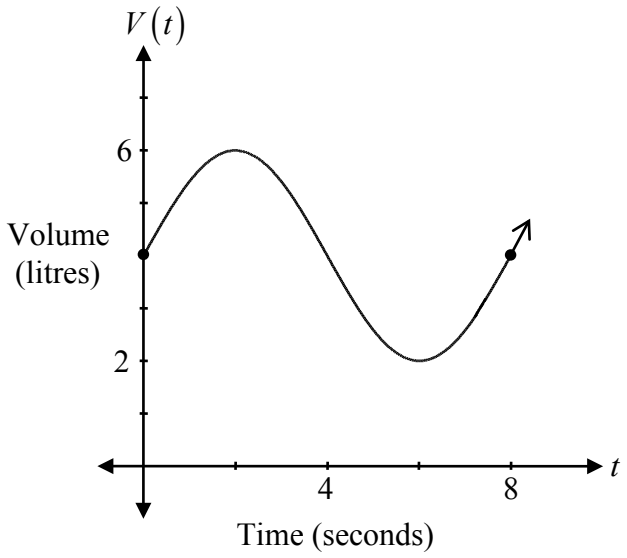


Question 41 — 1 mark — 137

Given the function $f(x) = \frac{2}{x} - 1$, justify why $f(f(2))$ is undefined.

Question 42 — 3 marks — 138

The following graph represents the volume of air in an adult's lungs. If $V(t)$ is the volume of air in litres and t is the time in seconds, determine an equation that represents this sinusoidal function.



$V(t) =$ _____

Question 43 — 1 mark — 139

Explain why the domain of $y = \log_2(x-1)$ is $x > 1$.

Question 44 — 2 marks — 140

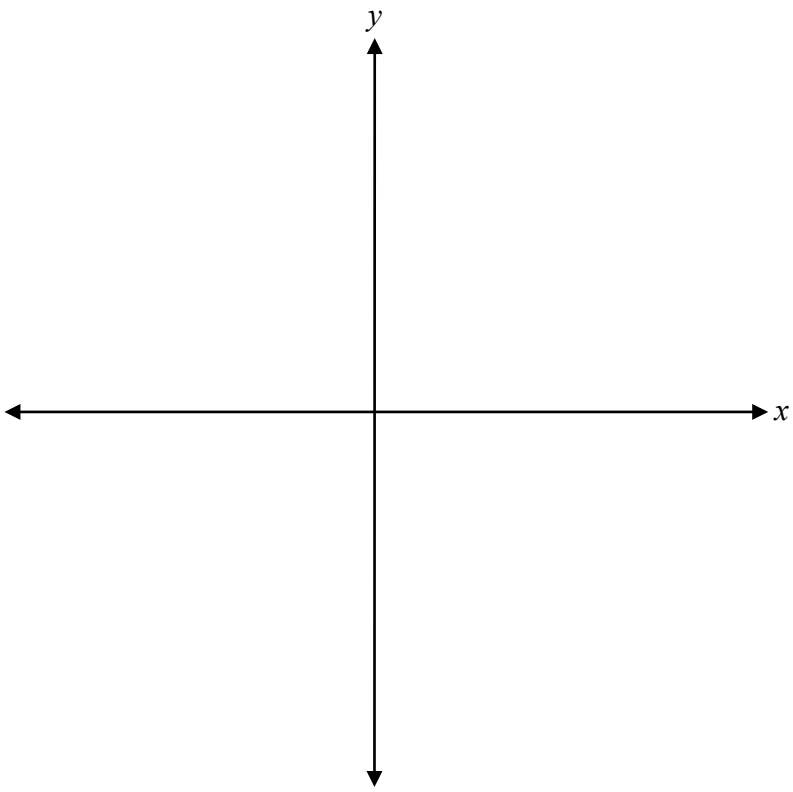
The point $(-2, 7)$ is on the terminal arm of an angle in standard position.

Determine the coordinates of the corresponding point, $P(\theta)$, on the unit circle.

Question 45 — 3 marks — 141

Sketch a graph of $P(x)$ that satisfies all of the following conditions:

- $P(x)$ is a polynomial function of degree 3.
- $P(x)$ has a zero at -3 with a multiplicity of 2.
- $P(x)$ has a zero at 1.
- $P(x)$ has a leading coefficient of -3.



Question 46 — 2 marks — 142

Determine how many 4-digit numbers greater than 4000 can be made using the digits 2, 3, 4, 5, and 6 if repetitions are not allowed.

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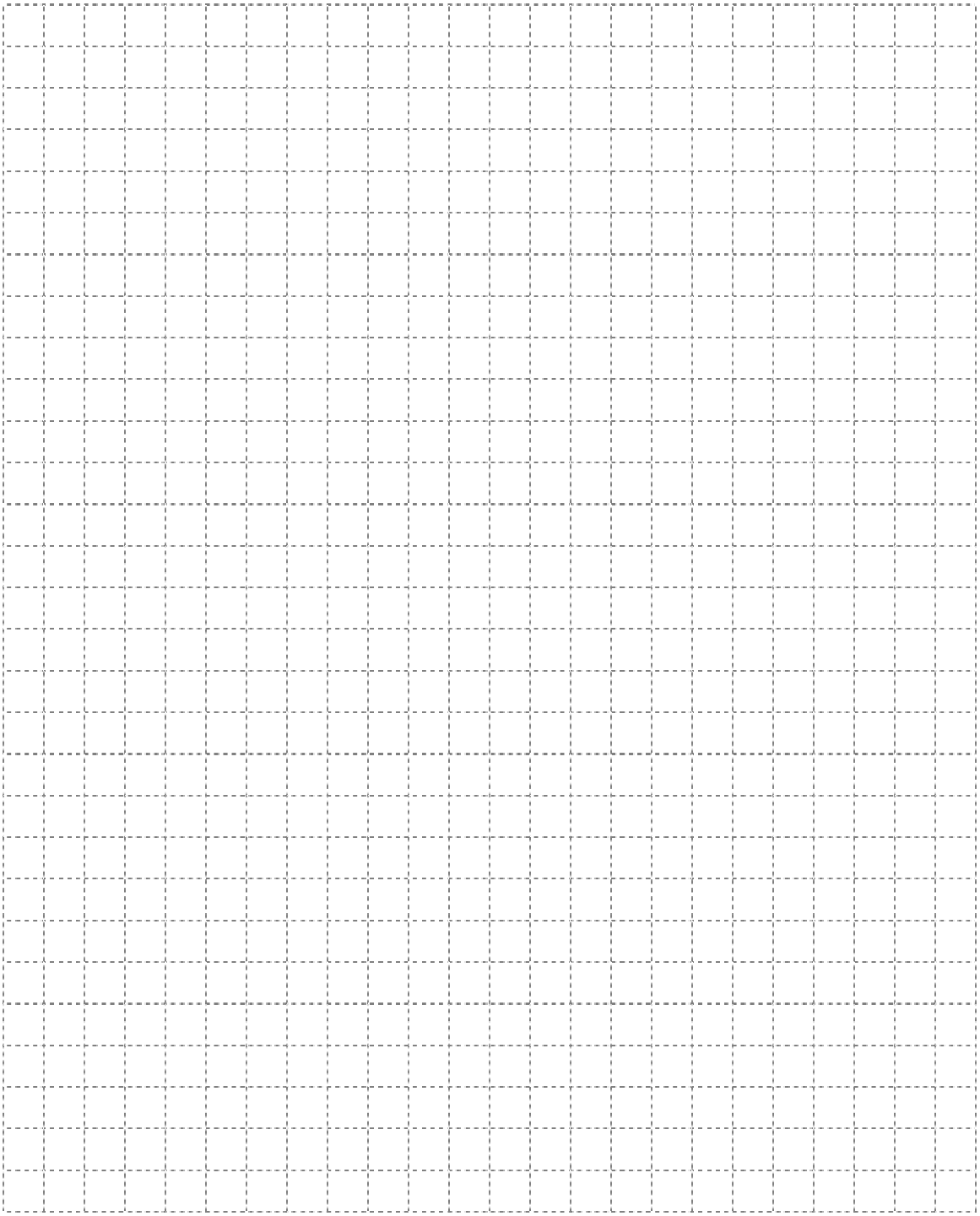

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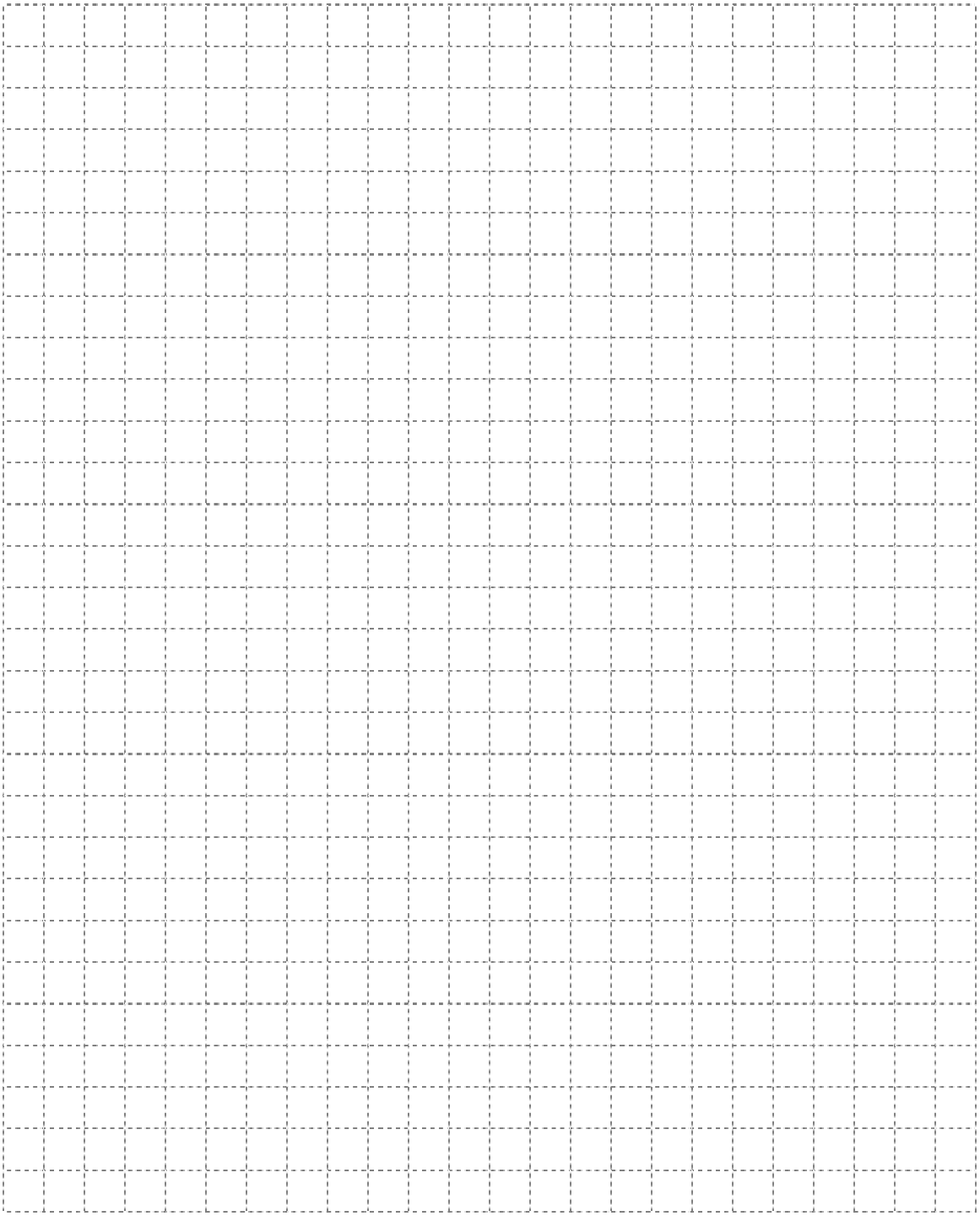

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