

QUEENS COLLEGE
DEPARTMENT OF MATHEMATICS
Final Examination
2 $\frac{1}{2}$ Hours

Mathematics 115

Fall 2024

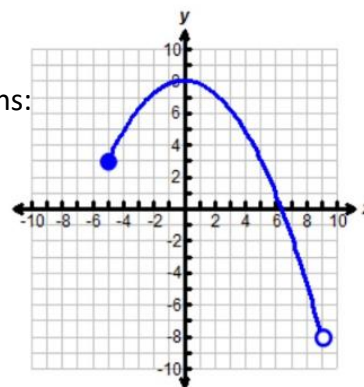
Directions: Answer all questions and show all your work in the provided blue book. Algebraic solutions are required. All answers must be in simplest form.

1. Consider two points, $A = (-2, 4)$ and $B = (0, 6)$.
- Find an equation of the line that passes through points A and B .
 - Find an equation of the vertical line that passes through point B .
 - Find the length of the line segment \overline{AB} .
 - Find an equation of the circle centered at point A with radius length $\sqrt{5}$.

2. A line L has equation $3x + 2y = 6$.
- Find the coordinates of the x -intercept and y -intercept of this line.
 - Find the slope of the line.
 - In words, explain how using the slope can help sketch the graph of the line.
 - Find an equation of the line parallel to line L that passes through $(2, 4)$.

3. Use the graph of $g(x)$ shown at right to answer the following questions:

- Is $g(x)$ a function? Explain your answer.
- What is $g(0)$?
- Find the value(s) of x for which $g(x) = 0$.
- What is the domain of $g(x)$, in interval notation?
- What is the range of $g(x)$, in interval notation?



4. Given that $c(x) = x^2 - 5x + 3$ and $d(x) = \frac{1}{\sqrt{x-3}}$:
- Evaluate and simplify $c(h - 1) - c(-1)$.
 - Rationalize the denominator of $d(x)$ and simplify.
 - Write the domain of $c(x)$ in interval notation.
 - Determine if $x = 5$ is in the domain of $d(x)$.

5. Factor completely or write PRIME.

- $x^2 + 49$
- $2x^2 - 50$
- $x^2 + 4x - 21$
- $6x^3 - 12x^2 - 18x$
- $6x^2 + 7x + 2$

6. Find all real solutions for each of the following equations.

- $(k - 1)(k + 1) = 8$
- $x^2 - 3x - 2 = 0$
- $\frac{12}{x - 2} = 2 + \frac{6(4 - x)}{x - 2}$
- $\sqrt{x + 2} = x$

7. Solve for r : $V = \frac{1}{3}\pi r^3$

(continued on the back)

8. Simplify the following expressions.

a) $\frac{4x^2 - 1}{9x - 3x^2} \div \frac{2x^2 - 7x - 4}{x^2 - 7x + 12}$

b) $\frac{6}{2x - 3} - \frac{4x}{2x - 3}$

c) $(3 - \sqrt{x})(2 - \sqrt{x}) + \sqrt{x}(5 - \sqrt{x})$

d) $\frac{2u}{u - 1} + \frac{1}{u} - \frac{2u - 1}{u^2 - u}$

9. Simplify and write your answer using only positive exponents:

$$\left(\frac{\frac{5}{3} - \frac{1}{2}}{8x \ y} \right)^{\frac{1}{3}} \div \left(\frac{-\frac{4}{3} \ \frac{5}{2}}{27x \ y} \right)$$

10. Simplify: $\frac{\frac{1}{x+h} - \frac{1}{x}}{h}$

11. Use the set of ordered pairs to determine whether the relation is a function.
 $\{(-3,27), (-2,8), (-1,1), (0,0), (1,1), (2,8), (3,27)\}$

12. Rationalize the denominators and simplify.

$$\frac{8}{\sqrt{5} + 2} + \frac{5}{\sqrt{5}}$$

13. Use long division to divide: $\frac{x^4 - 4x^3 + 2x^2 - 9x + 4}{x - 4}$

14. Given the parabola whose equation is $f(x) = -x^2 - 2x + 1$, find each of the following.

- a) The zeros.
- b) The coordinates of the y-intercept.
- c) The coordinates of the vertex.
- d) An equation of the axis of symmetry.

15. At Beans and Bagels, a bagel costs \$1 more than a cup of coffee. If 4 cups of coffee and 6 bagels costs \$31,

- a) write down a system of equations which can be used to determine the price of a bagel, b , and the price of a cup of coffee, c .
- b) solve for b and c .

Suggested Point Values (exam is out of 111 points):

- Questions 1, 2, 3, 4, 14: 2 points each part
- Questions 5, 6, 8, 15: 3 points each part
- Questions 7, 9, 10, 11, 12, 13: 4 points each part