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

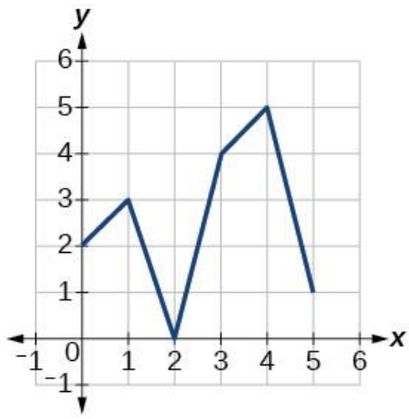
Mathematics 115 **Spring 2024**

Directions: Answer all questions and show all your work in the provided blue book. Solutions must be fully simplified and in algebraic form.

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

2. A line L has equation $4x - 10y = 20$.
   a. Find the coordinates of the *x*-intercept and *y*-intercept of this line.
   b. Find the slope and sketch a graph of the line using the slope and *y*-intercept.
   c. Find an equation of the line parallel to line *L* that passes through $(2, 4)$.

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



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

4. Given that $f(x) = 3x^2 + 4x - 4$ and $g(x) = \sqrt{2x + 5}$:
   a. Evaluate and simplify $f(h - 1) - f(-1)$.
   b. Evaluate $g(10)$.
   c. Write the domain of $f(x)$ in interval notation.
   d. Write the domain of $g(x)$ in interval notation.

5. Factor completely or write PRIME.
   a. $x^2 + 16$
   b. $12x^2 - 27$
   c. $x^2 + 2x - 63$
   d. $10x^3 - 35x^2 - 20x$

6. Find all real solutions for each of the following equations.
   a. $(x - 5)(x + 3) = -7$
   b. $2x^2 + 10x + 11 = 0$
   c. $\frac{5}{x + 3} - 2 = \frac{7}{x + 3}$
   d. $\sqrt{x - 1} = x - 1$

(continued on the back)

7. Simplify the following expressions.

a. $\dfrac{2x^2+3x-2}{6x^2-3x} \div \dfrac{x^2-4}{3x-6}$

b. $\dfrac{3x}{x-2} + \dfrac{6}{2-x}$

c. $\left(\sqrt{2x}+1\right)^2 - \sqrt{2}\left(\sqrt{x}+\sqrt{2}\right)$

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

$$\frac{(2x^2)^{-2}(x^6y^4)^{1/2}}{(27x^{-9}y^6)^{1/3}}$$

9. Simplify: $\dfrac{2-\dfrac{8}{x}}{\dfrac{1}{x}-\dfrac{4}{x^2}}$

10. If $(x^a x^{-4})^2 = x^4$, what is the value of *a*?

11. Rationalize the denominators and simplify.

$$\frac{6}{\sqrt{11}-3} + \frac{11}{\sqrt{11}}$$

12. Use long division to find the quotient: $\dfrac{x^4-16x^2+3x+12}{x+4}$.

13. Given the parabola whose equation is $f(x) = -x^2+4x+12$, 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

14. A student stops by a fundraiser bake sale on campus and buys 5 cookies and 8 granola bars for $38. A second student stops and buys 3 cookies and 4 granola bars for $20. What was the price of one granola bar at the bake sale?

<u>Suggested Point Values:</u>

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