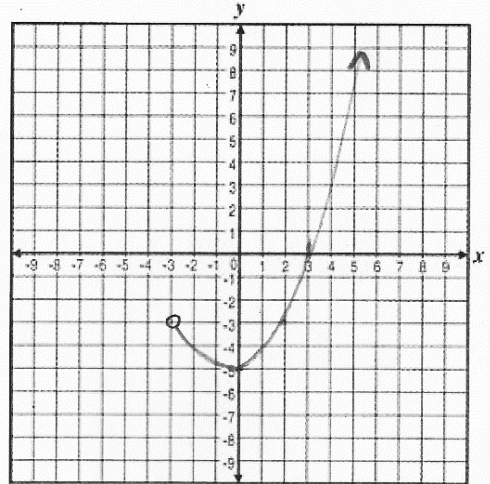


QUEENS COLLEGE
DEPARTMENT OF MATHEMATICS
FINAL EXAMINATION
 $2\frac{1}{2}$ HOURS

Mathematics 115

Spring 2022

Instructions: Answer all questions. Show all work.



1. Use the graph of the function $f(x)$ shown at the right to find
 - (a) the domain of $f(x)$.
 - (b) the range of $f(x)$.
 - (c) $f(-2)$.
 - (d) the value of x for which $f(x) = 3$.

2. Let $A = (-2, -3)$ and $B = (2, 5)$.
 - (a) Find the midpoint C of the line segment \overline{AB} .
 - (b) Find the length of the line segment \overline{AB} .
 - (c) Write an equation of the line passing through the points A and B in slope intercept form.
 - (d) Find an equation of the circle with radius 4 and centered at $A = (-2, -3)$.
 - (e) Graph the equation of the circle in part (d).

3. Given $f(x) = x^2 + 3x - 10$, $g(x) = \frac{x^2 + 3x - 10}{x^2 - 9}$, and $h(x) = 1 - \sqrt{x - 6}$,
 - (a) find $g(2)$.
 - (b) find $f(a + 3)$.
 - (c) the domain of $f(x)$.
 - (d) the domain of $g(x)$.
 - (e) the domain of $h(x)$.

4. For the graph of the function $y = -x^2 + 4x - 3$,
 - (a) determine the coordinates of its x -intercepts.
 - (b) determine the coordinates of its y -intercept.
 - (c) determine an equation of its axis of symmetry.
 - (d) determine the coordinates of its vertex.

5. Simplify:
 - (a) $\left(\frac{-20x^{-2}y^3}{10x^5y^{-6}}\right)^{-3}$
 - (b) $\left(3x^{\frac{1}{3}}y^{-\frac{5}{3}}\right)\left(-2x^{\frac{1}{3}}y^{-\frac{2}{3}}\right)^2$
 - (c) $7x^2y^2\sqrt{75x^5y^2} - 3\sqrt{12x^9y^6}$
 - (d) $\frac{4x + 5}{x^2 - x - 12} - \frac{3}{x - 4}$
 - (e) $\frac{\frac{1}{y^2} - \frac{1}{x^2}}{\frac{1}{x} - \frac{1}{y}}$

6. Solve each of the following:
 - (a) $2x^2 - 4x - 3 = 0$
 - (b) $\sqrt{4x + 1} + 9 = x + 4$
 - (c) $\frac{x + 5}{x + 1} - \frac{x}{x + 2} = \frac{4x + 1}{x^2 + 3x + 2}$

(continued on the back)

7. Factor completely:

(a) $8cx - 8ax + 2cy - 2ay$

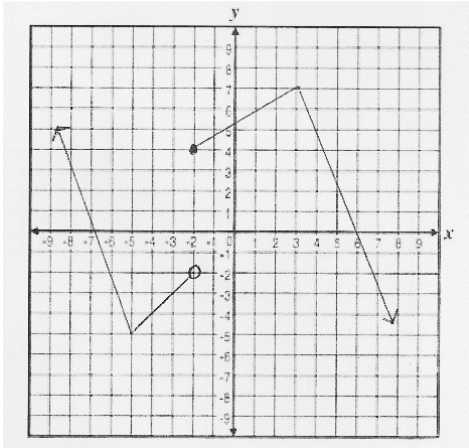
(b) $6x^3y^2 + 20x^2y^2 - 16xy^2$

(c) $3x^2 - 8x - 3$

8. Determine whether each of the following relations is a function. Explain your answers.

(a) $\{(3, 1), (3, 2), (3, 3), (3, 4)\}$

(b)



9. Solve the following system:

$$\begin{cases} 5x + 2y = 1 \\ 2x + 3y = 7 \end{cases}$$

10. Let L_1 be a line whose equation is $-5x + 3y = 6$ and L_2 be a line that passes through the points $(-2, -3)$ and $(3, -6)$. Determine if the lines L_1 and L_2 are parallel, perpendicular, or neither.

11. Use long division to divide $2x^3 + 4x^2 - 5$ by $x + 3$.

12. Rationalize the denominator and simplify. $\frac{15}{\sqrt{6}+1}$

13. Sketch the graph of the equation $3y + 2x = -6$. Label the x - and y - intercepts.

14. An electrician charges \$30 for a service call plus \$40 per hour of service. Write an equation in slope-intercept form for the cost, C , after h hours of service. What will be the total cost for 8 hours of work?

Suggested point values

Questions 1-4: 2pts for each part: total = 36pts

Questions 5-8: 3pts each part: total = 39 pts

Questions 9-13: 4pts each: total = 20 pts

Question 14: 5 points