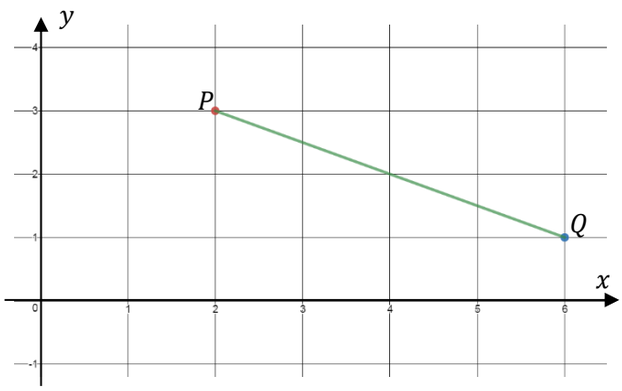
QUEENS COLLEGE
DEPARTMENT OF MATHEMATICS
FINAL EXAMINATION
$2\frac{1}{2}$ HOURS

Mathematics 115 **Spring 2017**

INSTRUCTIONS: **ANSWER ALL QUESTIONS.** **SHOW ALL WORK.**

1. Sketch the graph of each of the following equations. If the graph is a line, label the coordinates of its intercepts. If the graph is a circle, label the coordinates of its center, and state its radius.
   a) $y = \frac{2}{3}x + 6$
   b) $(x-4)^2 + (y+5)^2 = 36$
   c) $3x - 6y = 12$

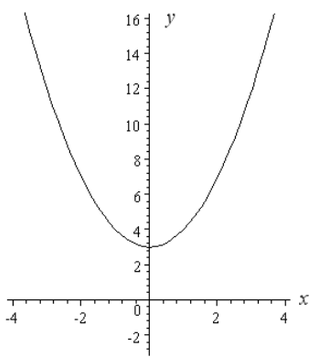
2. In the accompanying figure, the points $P(2,3)$ and $Q(6,1)$ are given.
   a) What is the slope of segment $\overline{PQ}$?
   b) What is the length of segment $\overline{PQ}$? Write your answer in simplest radical form.
   c) What is the midpoint of segment $\overline{PQ}$?
   d) Write an equation of any line that is perpendicular to $\overline{PQ}$.



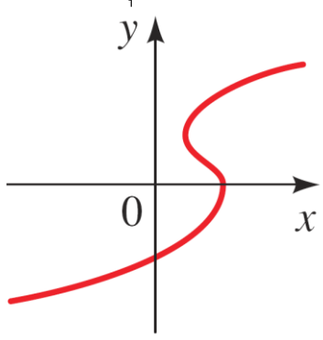
3. Use long division to find the quotient when $(x^3 - 7x + 6)$ is divided by $(x - 1)$.

4. Solve the following quadratic equations. Simplify your answers if possible.
   a) $x^2 + 7x = -12$
   b) $x^2 - 6x - 11 = 0$

5. Determine whether each of the following is a function. In each case, explain your answer.
   a) $\{(0,1), (1,2), (1,5), (3,7), (7,8)\}$
   b)



   c)



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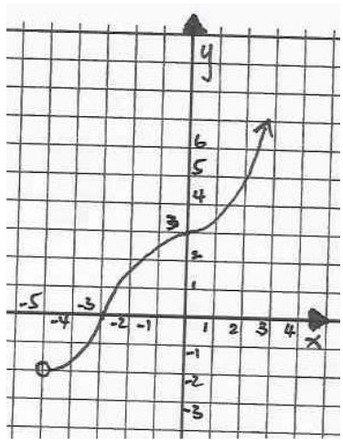
6. Solve the following system of linear equations:

$$5a - 2b = 20$$
$$2a + 3b = 27$$



7. Use the graph of $y = f(x)$ to find
   a) the domain of $f(x)$
   b) the range of $f(x)$
   c) the value of x for which $f(x) = 0$
   d) $f(0)$

8. Factor completely: $4x^3y - 32x^2y + 60xy$

9. Simplify: $2a\sqrt{25ab^4} + 8b\sqrt{a^3b^2}$

10. Divide: $\frac{x^2+x-12}{3x+6} \div \frac{x^2-5x+6}{12(x^2-4)}$

11. Simplify: $\frac{1-\frac{2}{x}}{1+\frac{2}{x}-\frac{8}{x^2}}$

12. Solve for x: $\frac{6}{x-3} - \frac{3}{8} = \frac{21}{4x-12}$

13. Given $f(x) = x^2 - 5x + 3$ and $g(x) = \frac{9}{x-4}$, find:
   a) $f(-2)$
   b) $g(7)$
   c) $f(x+2)$
   d) the domain of $g(x)$

14. Simplify and write with positive exponents only: $(2a^{1/3}b^{-2})^{-3}(4a^{2/3}b^{-4})^3$

15. Solve for n: $\sqrt{n-3} + 4 = 8$

16. Simplify: $\left(\sqrt{7x-5}\right)^2 - \left(\sqrt{7x}-5\right)^2$

17. Rationalize and simplify: $\frac{7}{4+\sqrt{2}}$

18. Find the zeros of the polynomial function $f(x) = 2x^3 - 2x$

19. George invested a total of \$2,000 at two different rates - x dollars at 5% and y dollars at 6%. His total interest income was \$106.
   a) Write a system of equations to model this problem.
   b) How much did George invest at each rate?