BRONX COMMUNITY COLLEGE
of the City University of New York

DEPARTMENT OF MATHEMATICS & COMPUTER SCIENCE

Review for Midterm 1. Prof. Luis Fernandez.

1. Sketch the graphs of the following linear equations:

   (a) $2x - 3y = 6$ (b) $x + 4y = 8$ (c) $y = -\frac{1}{2}x + 4$ (d) $y = 2x - 3$

2. Find the slope of the lines described by the following information:
   (a) With equation $y = \frac{2}{3}x + 4$
   (b) With equation $2x - 3y = 8$
   (c) Passing through the points $(4, -2)$ and $(5, 1)$
   (d) Perpendicular to the line with equation $x - 4y = 1$

3. Write an equation of the line described by the following information:
   (a) With slope $-\frac{1}{2}$ and passing through the point $(3, -2)$
   (b) Passing through the points $(2, -1)$ and $(-4, -3)$
   (c) perpendicular to the line with equation $y = 3x - 4$ and passing through $(1, 9)$.
   (d) Parallel to the line with equation $3x - 5y = 4$ and having the same y–intercept as the line with equation $x - 4y - 8 = 0$.

4. For each of the the following quadratic functions $f(x)$:
   A. $f(x) = (x - 2)^2 - 1$ B. $f(x) = x^2 + 2x - 3$ C. $f(x) = -3x^2 - 6x - 4$
   (a) Find the vertex.
   (b) State the domain of f.
   (c) State the range of f.
   (d) Find the x-intercept(s).
   (e) Find the y-intercept(s).
   (f) Sketch the graph of $y = f(x)$.

5. The graph of a parabola $y = f(x)$ has axis of symmetry $x = -1$, vertex $(-1, 5)$, and $f(0) = 3$.
   (a) Write the equation of the parabola in standard form.
   (b) State the domain and the range of f.
   (c) Sketch a graph of $y = f(x)$.

6. For each of the the following polynomials $p(x)$:
   A. $p(x) = x^3 - 3x^2 + 4$ B. $p(x) = -x^3 + 4x^2 - x - 6$ C. $p(x) = 2x^4 + 7x^3 + 6x^2 - x - 2$
   (a) List all possible rational roots of $p(x)$, according to the Rational Zeros Theorem.
   (b) Factor $p(x)$ completely.
   (c) Find all roots of the equation $p(x) = 0$.
   (d) Determine the end behavior of the graph of $y = p(x)$.
   (e) Determine the y–intercept of the graph of $y = p(x)$

(f) Determine the x–intercepts of the graph $y = p(x)$

(g) Determine the local behavior of $y = p(x)$ near the x-intercepts.

(h) Use the above information to sketch a graph of $y = p(x)$.

7. (a) State carefully the remainder theorem.

(b) Find the remainder of the division of $x^{122} - 20x^{51} + 60x^{34} + 1$ when divided by $x - 1$.

(c) State carefully the factor theorem.

(d) Find a polynomial of degree 4 with zeros at $x = 2$ and $x = 1$.

The answers

1. For the graphs see Figure 1.

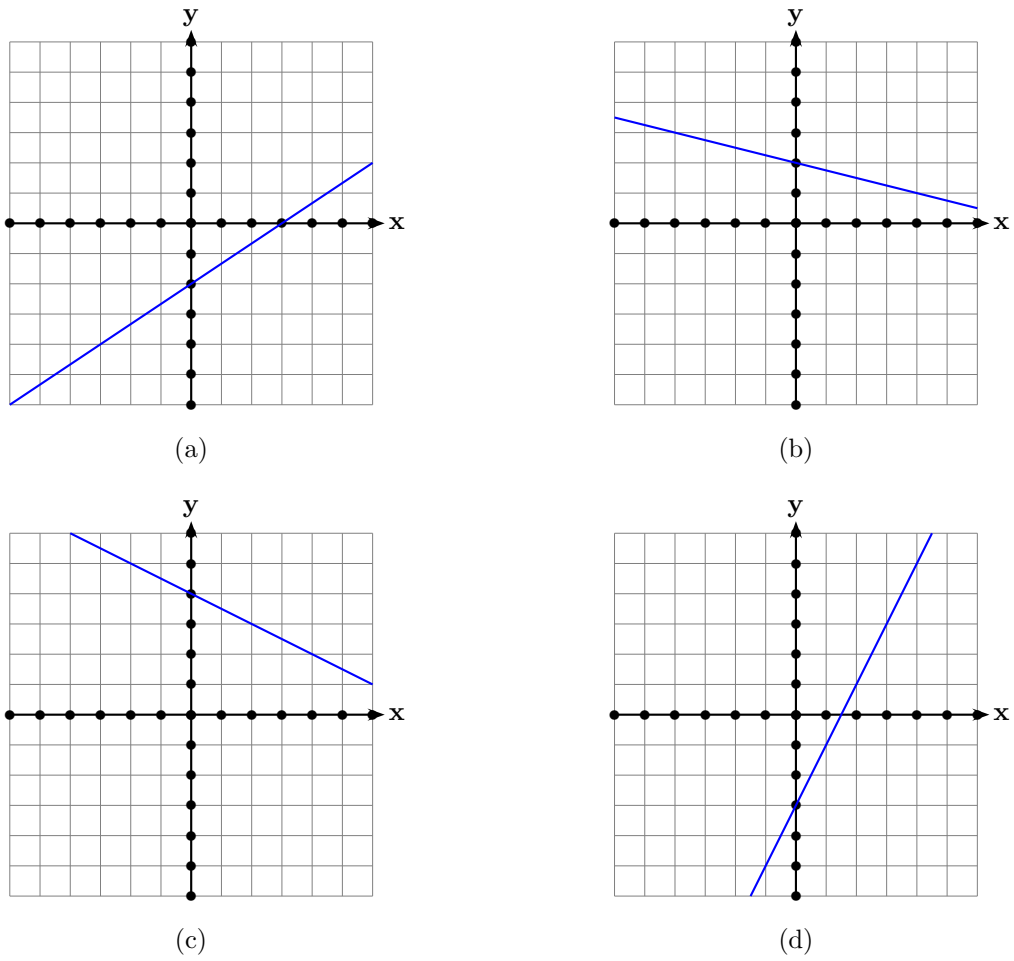


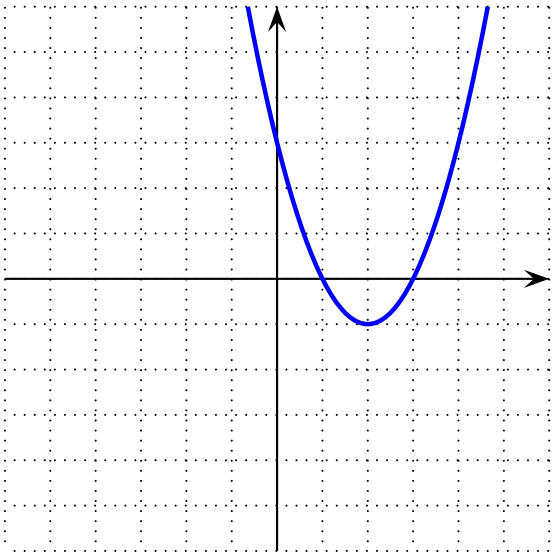
Figure 1: The graphs of Question 1

2. A. $\frac{2}{3}$ B. $\frac{2}{3}$ C. 3 D. -4

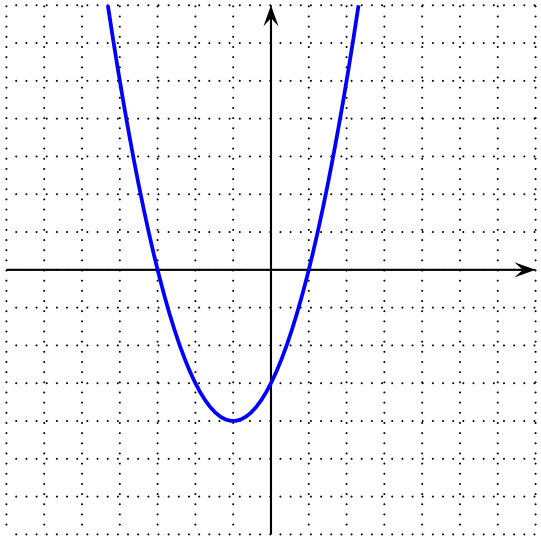
3. A. $x + 2y = -1$ B. $x - 3y = 5$ C. $y = -\frac{1}{3}x + \frac{28}{3}$ D. $y = \frac{3}{5}x - 2$

4. A. $(3, -2)$ B. $\left(\frac{42}{31}, -\frac{50}{31}\right)$ C. $\left(\frac{13}{8}, \frac{3}{4}\right)$

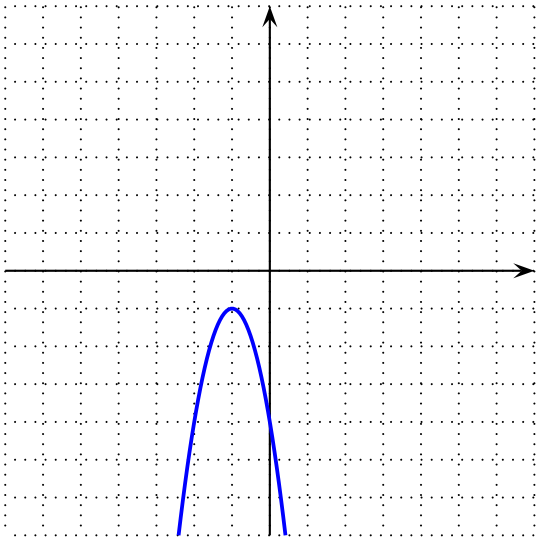
5. (a) A. $(2, -1)$ B. $(-\infty, \infty)$ C. $[-1, \infty)$
   (b) A. $(-1, -4)$ B. $(-\infty, \infty)$ C. $[-4, \infty)$
   (c) A. $(-1, -1)$ B. $(-\infty, \infty)$ C. $(-\infty, -1]$
   Answers to the remaining parts can be read from the graphs in Figure 2



A



B



C

Figure 2: The graphs in Question 5

6. A. $y = -2(x+1)^2 + 5$ B. Domain is $(-\infty, \infty)$, Range is $(-\infty, 5]$ C. See Figure 3

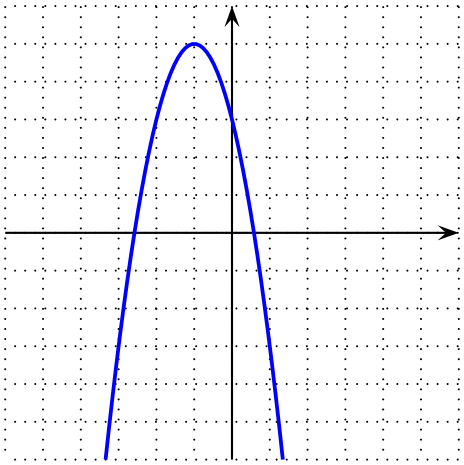


Figure 3: The parabola of Question 6

7. (a) A. $\{\pm 1, \pm 2, \pm 4\}$ B. $\{\pm 1, \pm 2, \pm 3, \pm 6\}$ C. $\{\pm 1, \pm 2, \pm \frac{1}{2}\}$

   (b) A. $(x+1)(x-2)^2$ B. $(x+1)(2-x)(x-3)$ C. $(x+1)^2(x+2)(2x-1)$

   (c) A. $x = -1$, $x = 2$ B. $x = -1$, $x = 2$, $x = 3$ C. $x = -1$, $x = -2$, $x = \frac{1}{2}$

   Answers to the remaining parts can be read from the graphs in Figure 4

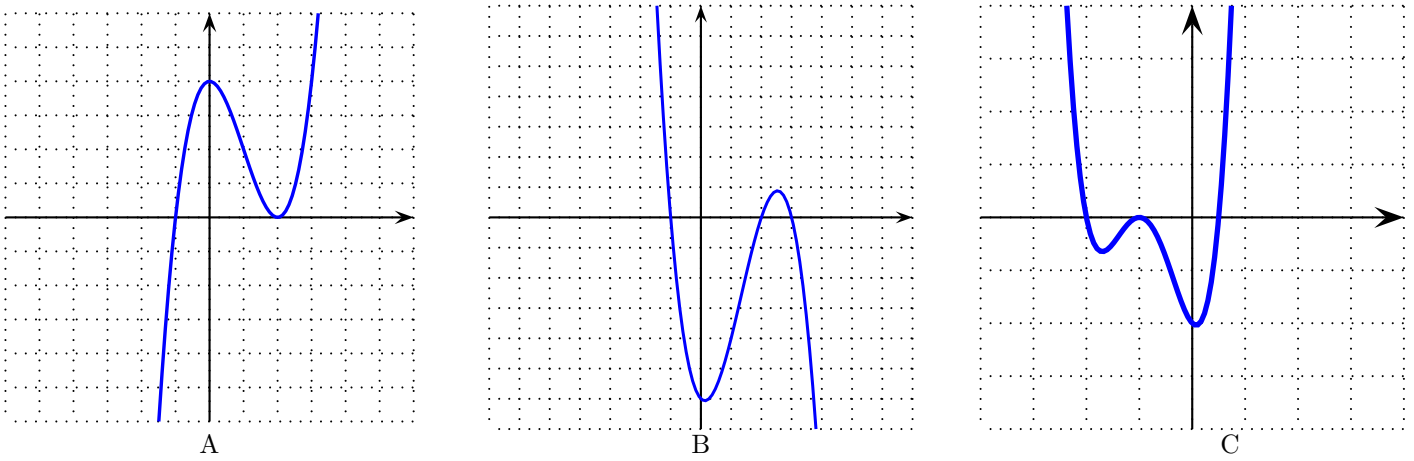


Figure 4: The graphs in Question 7

8. (a) The remainder we get when we divide a polynomial $f(x)$ by $(x - a)$ is always equal to $f(a)$.
   (b) By the Remainder Theorem the answer is $f(1) = 42$.
   (c) If $f(a) = 0$ then $(x - a)$ is a factor of $f(x)$, and if $(x - a)$ is a factor of $f(x)$ then $f(a) = 0$.
   (d) There are several possibilities. For example, $(x - 2)^2(x - 1)^2$, or $(x - 2)^3(x - 1)$.