1. Find all real solutions for $x$ and simplify your answers:
   
   (a) $2x^2 = 6 - x$  
   (b) $\frac{x}{x - 2} + \frac{1}{x + 3} = \frac{2x + 1}{x^2 + x - 6}$  
   (c) $x^2 + 2x - 2 = 0$

   (d) $x^4 - 8x^2 - 9 = 0$  
   (e) $-5 = x + \sqrt{x} + 17$  
   (f) $x^3 + 2x^2 - 3x - 6 = 0$  
   (g) $(2x - 1)^{1/3} = 2$  
   (h) $x^6 + 3x^3 - 40 = 0$  
   (i) $7 - 4(x + 2) = 3x + 5$

2. Simplify each of the following. Write any polynomials in standard form.
   
   (a) $\frac{2 - \frac{1}{2}}{3 + 1}$  
   (b) $\frac{1}{4} - \frac{x}{x}$  
   (c) $5x^2 + x - 3(x - 2)^2$  
   (d) $5(x + 1)^3$

   (e) $\frac{x^3 + 8}{x + 2}$  
   (f) $\frac{x^2 + 4}{x^2 - 6} \cdot \frac{x^2 - 4}{x^6}$  
   (g) $\frac{(x - 5) + 7}{(x - 5)(x + 2)}$

3. Factor completely:
   
   (a) $9x^2 - 25y^2$  
   (b) $x^4 + 3x^2 - 4$  
   (c) $a^3 - 27b^3$  
   (d) $y^3 + 2y^2 - 9y - 18$

   (e) $4a^2(3x - 1) - 9(3x - 1)$  
   (f) $27x^3 + 1$  
   (g) $8x^2 - 14x - 15$

4. Let $f(x) = \frac{x}{2} - 2$, $g(x) = x^2 - 3$. Find and simplify:
   
   (a) $(f \circ g)(x)$  
   (b) $(g \circ f)(x)$  
   (c) $g(x+h)$  
   (d) $f^{-1}(x)$  
   (e) $(g \circ g)(x)$  
   (f) $-f(x)$  
   (g) $f(-x)$

5. Consider the quadratic function $f(x) = -2x^2 - 8x + 10$.
   
   (a) Find the vertex.  
   (b) Find the y-intercept  
   (c) Find any x-intercept(s)

6. Solve each of the following. Write your answer in interval notation.
   
   (a) $-7 \leq 1 - 2x < 3$  
   (b) $\frac{5 - 3x}{4} \geq \frac{x - 8}{5}$  
   (c) $2x^2 + x > 15$  
   (d) $\frac{3x - 2}{x + 1} \leq 2$

7. Find an equation for each line. Write in slope-intercept form where possible.
   
   (a) Through the points $(-1, 4)$ and $(5, 2)$.  
   (b) Through the points $(3, -2)$ and $(3, 1)$.  
   (c) Parallel to the line $x - 2y + 6 = 0$ and containing the point $(-4, 3)$.  
   (d) Parallel to the line $y = 4$ and containing the point $(5, -2)$.  
   (e) Perpendicular to the line $3x + y - 7 = 0$ and containing the point $(1, -1)$.

8. Find the center and radius of each of the following circles:
   
   (a) $x^2 + y^2 + 6x + 8 = 0$  
   (b) $x^2 + y^2 - 2x + 4y - 2 = 0$

9. (a) Find the y-intercept of the line $5x + 2y - 3 = 0$.
   
   (b) Find the slope of the line $5x + 2y - 3 = 0$.

10. Find the y-intercept, the zeros and the multiplicity of each, and sketch the graph of: $f(x) = -x^3 + 3x^2$.

11. Find each of the following: (a) $3a^2 - 5ab^3$ when $a = -4$ and $b = -2$.  

12. Find the domain for each function:
   (a) \[ g(x) = \frac{3x}{x^2 + 16} \]
   (b) \[ h(x) = \sqrt{6 - 2x} \]
   (c) \[ f(x) = \frac{1 - x}{x^2 - 9} \]

13. Simplify completely, reducing all fractions.
   (a) \[ 8^{-4/3} \]
   (b) \[ \frac{(2a^{-3/2}b^3)^4}{ab^6} \]
   (c) \[ \left(\frac{16}{9}\right)^{-1/2} \]
   (d) \[ \frac{1}{x - 4} - \frac{7}{x^2 - x - 12} \]
   (e) \[ \sqrt[3]{45x^{13}} \]
   (f) \[ \frac{8}{a^2 + 2a} - \frac{4}{a} \]
   (g) \[ \sqrt{18} - \sqrt{2} \]

14. An open box with a square base is to be made from a square piece of sheet metal 9 inches on a side by cutting out a square from each corner and turning up the sides. Express the volume \( V \) of the box in terms of the length \( x \) of the side of the square cut from each corner.

15. Consider the two points \( A = (3, -2) \) and \( B = (5, 4) \).
   (a) Find the midpoint of the line segment joining the points \( A \) and \( B \).
   (b) Find the distance between the points \( A \) and \( B \).

16. Solve for \( x \):
   (a) \[ 4^{x-2} = \frac{1}{8} \]
   (b) \[ \left(\frac{1}{3}\right)^{x-5} = 81 \]
   (c) \[ e^{3x-4} = 7 \]
   (d) \[ \log_2(6x - 1) = 4 \]

17. (a) Find the equation of the quadratic function shown to the right with vertex \((-2, 3)\) and y-intercept \((0, -3)\).
   (b) Find the range of this function.
   (c) Find the domain of this function.
   (d) Find the x-intercepts.

18. Compute the following:
   (a) \[ \log_5 25 \]
   (b) \[ \log_2 \left(2^{10}\right) \]
   (c) \[ \log_7 7 \]
   (d) \[ \log_8 1 \]
   (e) \[ \log_3 \left(\frac{1}{9}\right) \]

19. Consider the function \( f(x) = 2^x - 2 \).
   (a) Find the y-intercept.
   (b) Find any x-intercepts.

20. When and where is the Final Exam for this course?
21. The graph of \( y = f(x) \) is shown below. Draw the graph of \( y = f^{-1}(x) \).

22. Solve the system of equations \[
\begin{align*}
2x + 2y &= 5 \\
4x + y &= 1
\end{align*}
\].

23. Solve for \( a \): \( 3x = \frac{a - 2b}{k + a} \).

24. Find the domain: \( f(x) = \sqrt{x^2 - x - 6} \).

25. Find equations of the polynomials graphs shown below.

26. Use the graph of the function \( f \) shown below to answer parts (a) – (e).

(a) Find \( f(2) \).
(b) For what values of \( x \) is \( f(x) = 0 \) ?
(c) What is the domain of \( f \)?
(d) What is the range of \( f \)?
(e) How many times does the graph of \( y = -2 \) cross the graph of \( f \)?
(f) Find \( f(3) \).
27. For the functions given, find any x-intercepts, y-intercepts, and give the domain.

(a) \( f(x) = \frac{3x - 2}{x + 1} \)  
(b) \( f(x) = \frac{x + 5}{x^2 - 9} \)  
(c) \( f(x) = \frac{x^2 - 3x - 4}{x - 2} \)

28. Rationalize the denominator and simplify your answer: 

(a) \( \frac{6}{\sqrt{10}} \)  
(b) \( \frac{2}{5 - \sqrt{3}} \)

29. Find the quotient and remainder when \( 2x^4 - 5x^3 + x - 7 \) is divided by \( x^2 + 3 \).

30. For \( f(x) = 5x^2 + x - 3 \), find \( \frac{f(x + h) - f(x)}{h} \) and simplify your answer.

31. Which of the following is/are functions?

A. \( x^2 + y^2 = 9 \)  
B.  
C.

32. Find the area of the shaded region. Express answer in terms of \( \pi \).

(a)  
(b)

33. Karla has received a graduation present of $4,000. She invests part of it in a certificate of deposit (CD) and the rest in a bond. At the end of one year she gets a combined total of $218 in interest from the two investments. The CD had an annual interest rate of 4% and the bond an annual interest rate of 6%. How much was invested in the bond?
ANSWERS

1. (a) \( \frac{3}{2}, -2 \)  (b) 1  (c) \(-1 \pm \sqrt{3}\)  (d) 3, -3  (e) -8  (f) \( \pm \sqrt{3} \), -2  (g) \( \frac{9}{2} \)
   (h) \(-2, \sqrt{5}\)  (i) \(-6/7\)

2. (a) 9/10  (b) \( \frac{x}{x^2 - 4} \)  (c) \( 2x^2 + 13x - 12 \)  (d) \( 5x^3 + 15x^2 + 15x + 5 \)  (e) \( x^2 - 2x + 4 \)
   (f) \( \frac{x - 2}{x^2(x - 3)} \)  (g) \( \frac{1}{x - 5} \)

3. (a) \((3x - 5y)(3x + 5y)\)  (b) \((x^2 + 4)(x - 1)(x + 1)\)  (c) \((a - 3b)(a^2 + 3ab + 9b^2)\)
   (d) \((y + 3)(y - 3)(y + 2)\)  (e) \((2a - 3)(2a + 3)(3x - 1)\)  (f) \((3x + 1)(9x^2 - 3x + 1)\)
   (g) \((2x - 5)(4x + 3)\)

4. (a) \( \frac{x^2 - 7}{2} \)  (b) \( \frac{x^2 - 8x + 4}{4} \)  (c) \( x^2 + 2xh + h^2 - 3 \)  (d) \( f^{-1}(x) = 2x + 4 \)  (e) \( x^4 - 6x^2 + 6 \)
   (f) \( -\frac{x}{2} + 2 \)  (g) \( -\frac{x}{2} - 2 \)

5. (a) \((-2, 18)\)  (b) \((0, 10)\)  (c) \((-5, 0), (1, 0)\)

6. (a) \((-1, 4]\)  (b) \((\infty, 57/10]\)  (c) \((\infty, -3) \cup (5/2, \infty)\)  (d) \((-1, 4]\)

7. (a) \( y = -\frac{1}{3}x + \frac{11}{3} \)  (b) \( x = 3 \)  (c) \( y = \frac{1}{2}x + 5 \)  (d) \( y = -2 \)  (e) \( y = \frac{1}{3}x - \frac{4}{3} \)

8. CENTER  RADIUS  9. (a) 3/2  (b) -5/2
   (a) \((-3, 0)\) 1
   (b) \((1, -2)\) \( \sqrt{7} \)
10. y-intercept: (0,0)  Zeros and multiplicities: 0, multiplicity 2; 3, multiplicity 1.

11. (a) \( 91/2 \)  (b) 29/4

12. (a) All real numbers  (b) \((\infty, 3]\)
   (c) All real numbers except -3, 3.

13. (a) \( \frac{1}{16} \)  (b) \( \frac{16b^{12}}{a^7} \)  (c) \( \frac{3}{4} \)  (d) \( \frac{1}{x + 3} \)  (e) \( 3x^6 \sqrt{5x} \)  (f) \( \frac{-4}{a + 2} \)  (g) \( 2\sqrt{2} \)

14. \( V = (9 - 2x)^2 \times x \)  15. (a) (4, 1)  (b) \( 2\sqrt{10} \)
16. (a) \(\frac{9}{4}\) (b) 1 (c) \(\frac{4 + \ln 7}{3}\) (d) \(\frac{17}{6}\)

17. (a) \(f(x) = -\frac{3}{2}(x + 2)^2 + 3\) (b) \((-\infty, 3]\) (c) All real numbers (d) \(-2 \pm \sqrt{2}\)

18. (a) 2 (b) 10 (c) 1 (d) 0 (e) -2

19. (a) (0, -1) (b) (1, 0)

20.

21. \(y = f^{-1}(x)\)

22. \(x = -\frac{1}{2}, y = 3\)

23. \(a = \frac{3kx + 2b}{1 - 3x}\) or \(a = \frac{-3kx - 2b}{3x - 1}\)

24. \((-\infty, -2] \cup [3, \infty)\)

25. (a) \(y = \frac{5}{8}(x + 1)(x - 2)(x - 4)\) (b) \(y = -4x^2(x + 2)^2\)

26. (a) -1 (b) 1, 3 (c) [-3, 5] (d) [-1, 2] (e) 0 times (f) 0

27. | x-intercepts | y-intercept | Domain |
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>(a) (2/3, 0)</td>
<td>(0, -2)</td>
<td>{x: x \neq -1}</td>
</tr>
<tr>
<td>(b) (-5, 0)</td>
<td>(0, -5/9)</td>
<td>{x: x \neq -3, x \neq 3}</td>
</tr>
<tr>
<td>(c) (-1, 0), (4, 0)</td>
<td>(0, 2)</td>
<td>{x: x \neq 3}</td>
</tr>
</tbody>
</table>

28. (a) \(\frac{3\sqrt{10}}{5}\) (b) \(\frac{5 + \sqrt{3}}{11}\)

29. Quotient: \(2x^2 - 5x - 6\) Remainder: 16x + 11

30. \(10x + 5h + 1\)

31. Function: C

32. (a) 64 - 16\(\pi\) square units (b) \(\frac{\pi}{2} - 1\) square units

33. $2900