2014 MATH 0999: LAB BOOK

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SOLUTIONS
DAY 1: DEFINITION OF SQUARE ROOTS

**SQUARE ROOT:**

\[ \sqrt{a} \text{ where } a > 0, \text{ means a positive real number } x \text{ such that } x^2 = a \]

Example 1: Evaluate

(A) \( \sqrt{9} \)  
(B) \( \sqrt{16} \)  
(C) \( \sqrt{9 + 16} \)  

(D) \( \sqrt{9} + \sqrt{16} \)  
(E) \( \sqrt{64} \)  
(F) \( -\sqrt{36} \)  

Example 2: Simplify the expression:

(A) \( \sqrt{40} \)  
(B) \( \sqrt{18} \)  
(C) \( \sqrt{24} \)  

(D) \( \sqrt{27} \)  
(E) \( \sqrt{128} \)  
(F) \( \sqrt{52} \)  

(G) \( \sqrt{48} \)  
(H) \( \sqrt{200} \)  
(I) \( \sqrt{32} \)  

Example 3: Simplify the expression:

(A) \( -3\sqrt{7} - 4\sqrt{7} \)  
(B) \( 2\sqrt{5} - 6\sqrt{5} \)  

(C) \( -\sqrt{12} + 3\sqrt{3} \)  
(D) \( 3\sqrt{8} + 3\sqrt{2} \)  

(E) \( 8\sqrt{49} - 14\sqrt{100} \)  
(F) \( 10\sqrt{32} - 6\sqrt{18} \)
(G) \(-3\sqrt{48} + 7\sqrt{75}\) 

(H) \(7\sqrt{80} - 2\sqrt{25}\)

(I) \(-3\sqrt{18} + 3\sqrt{8} - \sqrt{24}\) 

(J) \(-3\sqrt{2} + 3\sqrt{32} - 3\sqrt{8}\)

(K) \(\frac{2\sqrt{7}}{3} - \frac{\sqrt{7}}{6}\) 

(L) \(\frac{\sqrt{5}}{4} - \frac{\sqrt{5}}{6}\)

Example 4: Simplify the expression. Assume that all variables are positive.

(A) \(\sqrt{125x}\) 

(B) \(\sqrt{216x}\) 

(C) \(\sqrt{32x^2}\)

(D) \(\sqrt{80x^5}\) 

(E) \(\sqrt{27x^3y^4}\) 

(F) \(-2\sqrt{50x^2}\)

(G) \(3\sqrt{40x^3}\) 

(H) \(\sqrt{45x^2y^3}\) 

(I) \(\sqrt{75x^3y^5}\)
EXERCISE 1

1. Simplify the following expression
   (A) $\sqrt{121}$  
   (B) $-3\sqrt{64}$  
   (C) $5\sqrt{7} - 6\sqrt{7} + 3\sqrt{7}$  
   (D) $2\sqrt{52} - \sqrt{117}$  
   (E) $2\sqrt{27} - 4\sqrt{12} + 3\sqrt{48}$  
   (F) $2\sqrt{72} - 3\sqrt{50} - 5\sqrt{98}$  
   (G) $3\sqrt{32} - 4\sqrt{128} + 2\sqrt{8}$  
   (H) $4\sqrt{50} - 2\sqrt{45} + 5\sqrt{80}$  
   (I) $\frac{2\sqrt{8}}{3} - \frac{5\sqrt{2}}{6}$  
   (J) $\sqrt{3} - \frac{\sqrt{3}}{4}$

2. Simplify the expression. Assume that all variables are positive.
   (A) $\sqrt{28x^3y^3}$  
   (B) $6\sqrt{72x^2}$  
   (C) $-6\sqrt{150x}$
DAY 2: COMPLEX NUMBERS

COMPLEX NUMBERS: (Real numbers are complex number)

- Imaginary Unit: \( i = \sqrt{-1} \) and \( i^2 = -1 \)
- Standard Form of Complex Numbers: \( a + bi \) where \( a, b \) are real numbers
  \[
  \frac{a}{\text{real part}} + \frac{b}{\text{imaginary part}} i
  \]
- The conjugate of \( z = a + bi \) is \( \overline{z} = a - bi \)

Example 1: Simplify and Write it in the standard form

(A) \((4 + 7i) + (1 - 6i)\)  (B) \((1 + 2i) - (4 - 2i)\)

(C) \((-2 + 4i) + (3 - 6i)\)  (D) \((2 - 3i) - (5 - 6i)\)

(E) \(4(-2 + 3i)\)  (F) \((2 - i)(4 + 3i)\)

(G) \((3 - 2i)(3 + 2i)\)  (H) \((3 - 2i)^2\)

(I) \(\sqrt{-6} \cdot \sqrt{-2}\)  (J) \(\sqrt{-5} \cdot \sqrt{-10}\)
(K) $\sqrt{-44}$

(L) $\sqrt{-72}$

(M) $i^{63}$

(N) $i^{26}$

Example 2: Simplify and Write it in the standard form

(A) $i^{-27}$

(B) $i^{-81}$

(C) $\frac{3}{i}$

(D) $-\frac{14}{2i}$

(E) $\frac{2}{4-5i}$

(F) $\frac{13}{1-i}$

(G) $\frac{2-i}{3+2i}$

(H) $\frac{2-5i}{2-i}$
EXERCISE 2:

1. Simplify and Write it in the standard form.
   
   (A) \((5 - 7i) + (4i - 9)\)
   
   (B) \((6 - 3i) - (-2 - 3i)\)
   
   (C) \((5 - 4i)(5 + 4i)\)
   
   (D) \((2 - 5i)(5 - 3i)\)
   
   (E) \((5 - 4i)^2\)
   
   (F) \((3 - 7i)^2\)
   
   (G) \(\frac{3-2i}{2+4i}\)
   
   (H) \(\frac{5-3i}{i}\)
   
   (I) \(i^{35}\)
   
   (J) \(i^{-27}\)
DAY 3: COMMON FACTOR AND GROUPING METHOD

VARIABLES: A symbol for a number we don’t know yet. It is usually a letter like $x$ or $y$.

TERMS: In an algebraic expression, parts separated by plus or minus signs are called terms.

COEFFICIENTS: The numerical part, including the sign, of a term is called coefficient of the variable.

LIKE TERMS: If terms consist of the same variable(s) having the same exponent(s), they are called like terms: Like terms can be simplified.

<table>
<thead>
<tr>
<th>Like terms</th>
<th>Unlike terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9x^2, -5x^2$</td>
<td>$2x^2, 5x$</td>
</tr>
<tr>
<td>$-x^2y, 5x^2y$</td>
<td>$3x^2y, 5xy^2$</td>
</tr>
</tbody>
</table>

FACTORING: The process of writing an algebraic expression as a product of its factors is called factorization or factoring.

- Find the greatest common factor among each terms in the expression
- Using grouping (when it consists of 4 terms)

Example 1: Simplify (Expand)
(A) $(-2x^2 + 11x) - (x^2 - 8x + 7)$
(B) $2x(-x + 3) + 5x(x - 2)$
(C) $5a(4x - 3y)$
(D) $(3x - 2y)(5x + 3y)$
(E) $(2x - 3y)(2x + 3y)$
(F) $(3x - 2)^2$
(G) $(x - 3y)^2$
(H) $(3x - 5)^2$
Example 2: Factor out the greatest common factor.

(A) \(10c - 12s\)  
(B) \(-5m^2x^3 - 10m^4x\)

(C) \(24x^2y - 36xy^3\)  
(D) \(2x^6 - 9x^5 + 3x^3\)

(E) \(m^3x + m^5y + 3m^7z\)  
(F) \(a(5m - 4) + b(5m - 4)\)

(G) \(x^2(y + 1) - 5(y + 1)\)  
(H) \(a(b + 2) + c(b + 2)\)

Example 3: Factor the expression

(A) \(ax + bx - ay - by\)  
(B) \(10px + 15qx + 8py + 12qy\)

(C) \(36ax - 63ay - 4bx + 7by\)  
(D) \(x^3 - 2x^2 - 5x + 10\)

(E) \(4 - 2a - 2x + ax\)  
(F) \(x^3 + 3x^2 + 6x + 18\)
Example 4: Simplify the following expression

(A) \( \frac{12 - 2\sqrt{3}}{6} \)

(B) \( \frac{4 - 2\sqrt{11}}{8} \)

(C) \( \frac{x^2 - 2x}{x-2} \)

(D) \( \frac{3x^2 - 2x}{x} \)

(E) \( \frac{14x^2y^5 - 21y^3}{7y^3} \)

(F) \( \frac{16a^3b^5 + 8a^2b^2 - 4b^3}{4ab^3} \)

(G) \( \frac{8x - 10x^2}{2x} + \frac{12x^2 - 9x}{3x} \)

(H) \( \frac{6x^3 - 4x^2}{2x} - \frac{x^3 - 12x}{x} \)
EXERCISE 3:

1. Expand the expression and simplify
   (A) $2x(x - y) - 5y(x - 3y)$  
   (B) $(5x - 2y)(3x - 4y)$  
   (C) $(4x - 7)^2$

2. Factor out the greatest common factor.
   (A) $12x^2y^3 - 16x^3y$  
   (B) $2x^5 - 8x^4 + 14x^2$  
   (C) $(a - 3)x - (a - 3)t$

3. Factor
   (A) $ax - 3ay - x + 3y$  
   (B) $12x^3 - 16x^2 + 6x - 8$
   (C) $x^3 + 3x^2 + 4x + 12$  
   (D) $x^3 - 2x^2 + 5x - 10$

4. Simplify
   (A) $\frac{4x^3 - 6x}{2x - 3}$  
   (B) $\frac{9a^2b + 15ab}{3ab} + \frac{8a^3 - 6a^2}{2a^2}$
QUADRATIC EXPRESSION: Factor $x^2 - 7x + 12$ (when the coefficient of $x^2$ is 1)

**Step 1:** Find the two integers whose product is 12 and the sum is $-7$

<table>
<thead>
<tr>
<th>Factors of 12</th>
<th>Sums of factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 12</td>
<td>13</td>
</tr>
<tr>
<td>$-1, -12$</td>
<td>$-13$</td>
</tr>
<tr>
<td>2, 6</td>
<td>8</td>
</tr>
<tr>
<td>$-2, -6$</td>
<td>$-8$</td>
</tr>
<tr>
<td>3, 4</td>
<td>7</td>
</tr>
<tr>
<td>$-3, -4$</td>
<td>$-7$</td>
</tr>
</tbody>
</table>

**Step 2:** Write the factor form

\[ x^2 - 7x + 12 = (x - 3)(x - 4) \]

Example 1: Factor the expression.

(A) $x^2 + 3x + 2$  
(B) $x^2 - 7x + 6$

(C) $x^2 - 7x + 10$  
(D) $x^2 - 8x - 9$

(E) $x^2 - 13x + 42$  
(F) $x^2 + 15x + 44$

(G) $x^2 + 10x + 21$  
(H) $x^2 - x - 12$

(I) $x^2 - x - 30$  
(J) $x^2 + 5x - 36$

(K) $x^2 - 12x + 36$  
(L) $x^2 - 14x + 48$
Example 2: Factor the expression.

(A) \( x^2 - 3xy + 2y^2 \)  
(B) \( x^2 + xy - 6y^2 \)

(C) \( x^2 - 2xy - 8y^2 \)  
(D) \( x^2 + 9xy + 18y^2 \)

Example 3: Factor the expression.

(A) \( 5x^3 - 5x^2 - 30x \)  
(B) \( (a + 1)x^2 - 2(a + 1)x - 3(a + 1) \)
EXERCISE 4

1. Factor trinomial
   (A) $x^2 - 4x - 12$  (B) $x^2 - 9x + 14$

   (C) $x^2 + 10x + 16$  (D) $x^2 - 11x - 26$

   (E) $x^2 + x - 20$  (F) $x^2 - 15x + 50$

   (G) $x^2 - 16$  (H) $x^2 + 2x + 10$

2. Factor
   (A) $x^2 - 4xy - 5y^2$  (B) $x^2 - 8xy - 20y^2$

3. Factor
   (A) $2x^2 + 22x + 60$  (B) $x^3 - 7x^2 + 6x$
DAY 5: FACTOR TRINOMIAL (HARD)

Factor \(2x^2 - 7x + 3\) (when the coefficient of \(x^2\) ≠ 1)

**Step 1:** Find the two integers whose product is \(2 \cdot 3 = 6\) and the sum is \(-7\)

<table>
<thead>
<tr>
<th>Factors of 12</th>
<th>Sums of factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 6</td>
<td>7</td>
</tr>
<tr>
<td>(-1, -6)</td>
<td>(-7)</td>
</tr>
<tr>
<td>2, 3</td>
<td>5</td>
</tr>
<tr>
<td>(-2, -3)</td>
<td>(-5)</td>
</tr>
</tbody>
</table>

**Step 2:** Write the factor form by Grouping

\[
2x^2 - 7x + 3 \\
= 2x^2 - x - 6x + 3 \\
= x(2x - 1) - 3(2x - 1): \text{Grouping} \\
= (2x - 1)(x - 3)
\]

Example 1: Factor the expression.

(A) \(2x^2 - x - 1\)  
(B) \(3x^2 + 10x + 7\)

(C) \(2x^2 + 9x + 10\)  
(D) \(3x^2 - 20x - 7\)

(E) \(6x^2 - x - 1\)  
(F) \(4x^2 + 4x + 1\)

(G) \(4x^2 - 5x - 9\)  
(H) \(15x^2 + x - 2\)

(I) \(9x^2 - 6x + 1\)  
(J) \(5x^2 + 12x + 4\)
Example 2: Factor the expression.

(A) $2x^2 + 7x - 15$  
(B) $6x^2 + x - 1$

(C) $10x^2 - 9x + 2$  
(D) $3x^2 - 5x - 2$

(E) $6x^2 + 13x + 6$  
(F) $4x^2 + 12x + 9$

(G) $3x^2 - xy - 10y^2$  
(H) $12x^2 - 7xy + y^2$

(I) $24x^3 - 41x^2y - 14xy^2$  
(J) $2(a + 1)x^2 - 3(a + 1)x + (a + 1)$
EXERCISE 5

1. Factor
(A) $2x^2 + 3x - 9$  
(B) $3x^2 - 8x + 4$

(C) $6x^2 - 17x + 12$  
(D) $3x^2 - 2x - 5$

(E) $2x^2 + 11x + 5$  
(F) $8x^2 + 2x - 3$

2. Factor
(A) $2x^2 + 5xy + 2y^2$  
(B) $6x^2 - xy - y^2$

(C) $2x^3 - 7x^2 + 3x$  
(D) $3x^3 - 4x^2 + x$
## SPECIAL FACTORING FORMULA

- $A^2 + 2AB + B^2 = (A + B)^2$
- $A^2 - 2AB + B^2 = (A - B)^2$
- $A^2 - B^2 = (A - B)(A + B)$
- $A^3 + B^3 = (A + B)(A^2 - AB + B^2)$
- $A^3 - B^3 = (A - B)(A^2 + AB + B^2)$

### Example 1: Factor the expression.

(A) $x^2 - 10x + 25$

(B) $x^2 + 4x + 4$

(C) $x^2 - 8x + 16$

(D) $x^2 + 6x + 9$

(E) $16x^2 - 40x + 25$

(F) $4x^2 - 4x + 1$

(G) $x^2 - 16$

(H) $25 - x^2$

(I) $4x^2 - 9$

(J) $9x^2 + 16$
Example 2: Factor the expression.

(A) $x^3 - 1$  

(B) $x^3 + 8$

(C) $x^3 - 27$  

(D) $x^3 + 64$

(E) $8x^3 - y^3$  

(F) $27x^3 + 8y^3$

(G) $x^4 - 16$  

(H) $x^6 - 1$

(K) $25x^2 - 9$  

(L) $9x^2 - 16$
EXERCISE 6

1. Factor
   (A) $x^2 - 49$  
   (B) $9x^2 - 36y^2$

   (C) $x^2 - 12x + 36$  
   (D) $x^2 + 18x + 81$

   (E) $4x^2 - 20x + 25$  
   (F) $9x^2 - 42x + 49$

   (G) $8x^3 - y^3$  
   (H) $27x^3 + 8$
DAY 7: SOLVE QUADRATIC EQUATION.

How to solve the quadratic equation?

- First, check that we can use Square root method: “( )^0 = constant” case
- Second, if we cannot use square root method, use quadratic formula:
  \[ ax^2 + bx + c = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]
- Or, we can factor

Example 1: Solve the quadratic equation

(A) \( x^2 - 16 = 0 \) 
(B) \( x^2 + 9 = 0 \)

(C) \( x^2 - 36 = 0 \) 
(D) \( x^2 + 49 = 0 \)

(E) \( 4x^2 - 9 = 0 \) 
(F) \( 25x^2 = 16 \)

(G) \( (x - 5)^2 = 12 \) 
(H) \( (x + 3)^2 = 32 \)

Example 2: Solve the quadratic equation

(A) \( 5x^2 - 15x = 0 \) 
(B) \( 6x^2 = 3x \)

Example 3: Solve the quadratic equation

(A) \( (x + 3)(2x - 1) = 0 \) 
(B) \( x^2 - 6x + 8 = 0 \)
(C) $x^2 - 5x = 6$ \hspace{1cm} (D) $x^2 - 2x = 8$

(E) $x^2 - 2x = 5x - 12$ \hspace{1cm} (F) $2x^2 + 3 = 7x$

(G) $6x^2 - x = 2$ \hspace{1cm} (H) $3x^2 + 5x - 2 = 0$

(I) $4x^2 - 2x + 3 = 0$ \hspace{1cm} (J) $2x^2 + 2x - 1 = 0$

(K) $x(3x - 10) = -12$ \hspace{1cm} (L) $x^2 - 6x = 1$

**Example 4:** Solve the quadratic equation

(A) $3x(2x + 5) = 4(2x + 5)$ \hspace{1cm} (B) $(x + 3)^2 = 4(x + 3)$

(C) $2x^3 = 8x^2$ \hspace{1cm} (D) $x^3 - x^2 - 6x = 0$

(E) $x^3 + x^2 - 20x = 0$ \hspace{1cm} (F) $x^3 = 3x + 2x^2$

**Example 5:** The length of a rectangle is 5 cm greater than its width. The area of the rectangle is 36 square centimeters. Find the length of the rectangle.
EXERCISE 7

1. Solve the following equation.
   (A) \( x^2 + 16 = 0 \)
   (B) \( (x - 2)^2 = 12 \)
   (C) \( (x + 5)^2 = 32 \)
   (D) \( 5x^2 + 20x = 0 \)
   (E) \( 2x^2 - 6x + 3 = 0 \)
   (F) \( 4x^2 - 6x + 5 = 0 \)
   (G) \( 2x^2 - 8x + 13 = 0 \)
   (H) \( x(x - 6) = 3 \)
   (I) \( 5x^2 + 9x = -4 \)
   (J) \( x(x - 4) + 5 = 0 \)

2. Solve the following equation.
   (A) \( x^3 - 5x^2 + 4x = 0 \)
   (B) \( 2x^3 - 9x^2 + 4x = 0 \)
PRACTICE PROBLEMS FOR UNIT 1

1. Simplify each of the following. Write your final answer in standard $a + bi$ form.
   
   (A) $\frac{2}{1-2i}$  
   (B) $\frac{5-i}{3+2i}$  
   (C) $i^{-23}$  
   (D) $i^{14}$

2. Simplify each of the following. Write your final answer in standard $a + bi$ form.
   
   (A) $(5 - 3i) - (8 - 9i)$  
   (B) $(13 + 2i) + (5 - 8i)$  
   (C) $(3 - 7i)(2 - i)$  
   (D) $(4 - 7i)^2$

3. Simplify each of the following expressions.
   
   (A) $4x - [2y - 3(3x - 4y)]$  
   (B) $-3x^3(4x^2 + 7x - 5)$  
   (C) $(3k - 6)(2k + 1)$  
   (D) $(5p^2 + 3p)(p^3 - p^2 + 5)$  
   (E) $(6m - 5)(6m + 5)$  
   (F) $(2r + 5t)^2$  
   (G) $\frac{8ab^2 - 6a^2b}{2ab}$  
   (H) $\frac{16x^2 - 25}{4x+5}$

4. Factor each of the following expressions.
   
   (A) $p^2 + 4p + pq + 4q$  
   (B) $q^2 + 6q - 27$  
   (C) $y^2 - 13y + 40$  
   (D) $x^2 + 3x - 28$  
   (E) $r^2 - r - 56$  
   (F) $x^2 - 2x - 24$  
   (G) $3x^2 - 5x - 2$  
   (H) $8x^2 - 14x - 9$  
   (I) $2x^2 + 7x + 5$  
   (J) $9x^2 + 30x + 25$  
   (K) $8p^3 - 24p^2 - 80p$  
   (L) $3x^4 + 30x^3 + 48x^2$  
   (M) $49y^2 - 25w^2$  
   (N) $x^2 + 100$  
   (O) $36x^2 - 25$  
   (P) $x^3 - 64$  
   (Q) $x^4 - 81$  
   (R) $x^3 + 8$

5. Solve the equation
   
   (A) $x^3 - 4x^2 - 2x + 8 = 0$  
   (B) $y^2 = 8y$  
   (C) $x^2 = -15 + 8x$  
   (D) $t^2 = 12(t - 3)$  
   (E) $81t^2 - 64 = 0$  
   (F) $(x - 3)^2 = 12$  
   (G) $2x^2 - 2x + 1 = 0$  
   (H) $4x^2 - 2x + 1 = 0$  
   (I) $x(x - 4) = 5$  
   (J) $x(x - 6) + 25 = 0$

6. Simplify the following expression. Assume all variables are positive.
   
   (A) $\sqrt{128}$  
   (B) $\sqrt{28}$  
   (C) $\sqrt{108x^2}$  
   (D) $\sqrt{45 - \sqrt{125}} + \sqrt{500}$  
   (E) $\sqrt{72} - 3\sqrt{18} + 2\sqrt{8}$  
   (F) $3\sqrt{2} - 2\sqrt{32} + \sqrt{98}$

7. The length of a rectangular rug is 6 feet more than the width. The area is 40 square feet. Find the length and width of the rug.
DAY 8: RADICAL EXPRESSION

N-TH ROOT:

- $n$ even : $\sqrt[n]{a}$ where $a > 0$, means a positive real number $x$ such that $x^n = a$
- $n$ odd : $\sqrt[n]{a}$ means a real number $x$ such that $x^n = a$

PROPERTIES

- $\sqrt[n]{a} \cdot b = \sqrt[n]{ab}$
- $\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

Example 1: Simplify the radical. Assume all variables are positive

(A) $\sqrt[3]{8}$  (B) $\sqrt[3]{-27}$  (C) $\sqrt[4]{243}$

(D) $\sqrt[3]{16x^3}$  (E) $\sqrt[3]{81x^4y^5}$  (F) $\sqrt[3]{16x^5}$

Example 2: Simplify the radical. Assume all variables are positive.

(A) $\sqrt[4]{\frac{2}{49}}$  (B) $\sqrt[3]{\frac{x^8}{9}}$

(C) $3\sqrt[3]{2} \cdot \sqrt[3]{6}$  (D) $2\sqrt[5]{\sqrt{6} + 2}$

(E) $\sqrt[3]{-3\sqrt{2}(2 + \sqrt{6})}$  (F) $\sqrt[3]{-5\sqrt{10} + \sqrt{6}}$

(G) $(2 - \sqrt{3} + 2)(\sqrt{3} - 5)$  (H) $(5 - 4\sqrt{5})(-2 + \sqrt{5})$
Example 3: Rationalize the denominator

(A) \( \frac{1}{\sqrt{5} - 2} \)  

(B) \( \frac{2}{5 - \sqrt{10}} \)  

(C) \( \frac{3 + \sqrt{2}}{2 - \sqrt{3}} \)  

(D) \( \frac{2}{\sqrt{11} - \sqrt{7}} \)  

Example 4: Find the distance and Midpoint between the two points.

(A) \((-5, 3)\) and \((3, -4)\)  

(B) \((-5, -4)\) and \((1, 2)\)  

(C) \((2, 3)\) and \((-1, 7)\)  

(D) \((8, -5)\) and \((-1, -3)\)
EXERCISE 8

1. Simplify
   (A) \( \sqrt[3]{32x^3y^5} \)  
   (B) \( 2\sqrt[4]{8x^4y} \)  
   (C) \( 4\sqrt[4]{64x^4y^2} \)

2. Simplify
   (A) \((\sqrt{5} - 2)(\sqrt{5} + 2)\)  
   (B) \((3\sqrt{2} - 2)(4\sqrt{2} + 1)\)  
   (C) \((\sqrt{10} - \sqrt{3})^2\)  
   (D) \(\sqrt{\frac{128}{9}}\)

3. Rationalize the denominator
   (A) \( \frac{2}{\sqrt{5}} \)  
   (B) \( \frac{5}{4 - \sqrt{2}} \)

4. Find the distance between the following two points.
   (A) \((-4, -5)\) and \((2, -1)\)  
   (B) \((6, -3)\) and \((-1, 1)\)
DAY 9: RATIONAL EXPONENTS

PROPERTIES OF EXPONENTS

- \( a^n \cdot a^m = a^{n+m} \)
- \( (a^n)^m = a^{n\cdot m} \)
- \( a^{-n} = \frac{1}{a^n} \)
- \( \frac{a^n}{a^m} = a^{n-m} \)
- \( a^0 = 1 \)
- \( \sqrt[n]{a^m} = a^{m/n} \)

Example 1: Simplify and assume that all variables are positive.

(A) \( \sqrt{81} \)  

(B) \( \sqrt[3]{-125} \)  

(C) \( \sqrt[4]{16} \)

(D) \( \sqrt{98} \)  

(E) \( \sqrt[3]{32} \)  

(F) \( \sqrt{x^5} \)

(G) \( \sqrt{x^7} \)  

(H) \( \sqrt[3]{4x^2y^3} \)  

(I) \( \sqrt[3]{8x^6y^7} \)

(J) \( \sqrt{16x^2} - 3\sqrt{4x^2} + 5\sqrt{49x^2} \)  

(K) \( \frac{x^6}{\sqrt{16}} \)  

(L) \( x^3\sqrt{64xy} - \sqrt[3]{8x^4y} \)

Example 2: Write the exponential as a radical expression.

(A) \( 2^{1/2} \)  

(B) \( -7^{2/5} \)  

(C) \( 9x^{2/3} \)
Example 3: Simplify and write it with only positive exponent. Assume that all variable are positive.

(A) \((x^3y^2)(x^{11}y^{-5})\)  \hspace{1cm} (B) \((2x^4y^{-2})^3\)  \hspace{1cm} (C) \(\frac{xy^3}{x^6y^2}\)

(D) \(x^{3/2}x^{1/3}\)  \hspace{1cm} (E) \((x^{1/2})^3\)  \hspace{1cm} (F) \(\frac{x^{2/3}}{x^{1/6}}\)

(G) \((x^{2/3}y^{5/2})^{3/4}\)  \hspace{1cm} (H) \((a^{1/4}b^{-1/3})^6\)  \hspace{1cm} (I) \(a^{-3/4}(a^{2/3} + a^{3/2})\)

(J) \(x^{5/4}(x^{-2/5} - x^{3/5})\)  \hspace{1cm} (K) \(\sqrt{x} \cdot \sqrt[3]{x}\)  \hspace{1cm} (L) \(\left(\frac{x^{2/3}y^{-2/3}}{y^2}\right)^6\)
EXERCISE 9

1. Write the radical expression as the exponential expression.
   (A) \( \sqrt[3]{x} \) \hspace{1cm} (B) \( \sqrt[4]{x^3} \)

2. Simplify and write it as the exponential expression with positive exponent.
   (A) \( x^{1/3} \cdot x^{1/2} \) \hspace{1cm} (B) \( \frac{x^{5/6}}{x^{1/3}} \)

3. Simplify
   (A) \( (x^{1/4} y^{5/6})^{2/3} \) \hspace{1cm} (B) \( a^{2/3} \left( a^{3/4} - a^{6/5} \right) \)
DAY 10: EQUATION OF RADICAL

Example 1: Solve the equation

(A) $\sqrt{2x + 3} = x$ 

(B) $\sqrt{8 - 2x} = x$ 

(C) $\sqrt{12 - x} = x$ 

(D) $\sqrt{x + 6} = x$ 

(E) $\sqrt{4x + 12} = x$ 

(F) $\sqrt{x + 30} = x$ 

(G) $\sqrt{x^2 - 3x + 1} = x - 2$ 

(H) $\sqrt{x^2 - 5x} = x - 3$ 

(I) $\sqrt{x^2 + 2x + 5} = x + 2$ 

(J) $\sqrt{x^2 + 7x + 2} = x + 3$ 

(K) $\sqrt[3]{x + 3} = \sqrt[3]{2x - 1}$
EXERCISE 10

1. Solve the equation.
   
   (A) \( \sqrt{x - 3} = 5 \)
   
   (B) \( \sqrt{x^2 + 2x + 10} = x + 2 \)

   (C) \( \sqrt{3x + 4} = x \)

   (D) \( \sqrt[3]{3x + 10} = \sqrt[3]{x + 20} \)
DAY 11: REVIEW OF GRAPH AND SLOPE OF LINE

Example 1: Plot ordered pairs:

(A) \((3, -4)\)  
(B) \((-4, 2)\)  
(C) \((-5, -3)\)

Example 2: Find the y-intercepts and slope. Draw the graph of the function.

(A) \(3x - y = 5\)  
(B) \(4x + 3y = 6\)  
(C) \(y = 3x + 5\)

(D) \(2x - 5y = 0\)  
(E) \(x = 3\)  
(F) \(y = 2\)
Example 3: Find the slope of the line through the points

(A) $(2, -1), (-4, 1)$  

(B) $(-3, 2), (2, 5)$  

(C) $(-5, -4), (2, 3)$  

(D) $(6, -3), (-1, 5)$  

(E) $(-4, -3), (2, -1)$  

(F) $(3, -4), (-2, -3)$  

(G) $(2, -1), (-2, -1)$  

(H) $(2, -3), (2, 1)$
EXERCISE 11

1. Find the slope and y-intercept of the following line.

(A) \( y = \frac{1}{3}x - 5 \)  
(B) \( 6x + 5y = 7 \)

(C) \( 3y - 4x = 24 \)  
(D) \( 5x - 2y = 10 \)

(E) \( y = 2 \)  
(F) \( x = 5 \)

2. Draw the graph of the following line.

(A) \( y = 3x - 4 \)  
(B) \( 2x + y = -2 \)
DAY 12: FIND THE EQUATION OF THE LINE

Example 1: Find the equation of the straight line (the linear function) such that
(A) has slope 4 and contains the point \((-1, 3)\)

(B) has slope 2 and contains the point \((3, -1)\)

(C) has slope \(\frac{1}{3}\) and contains the point \((2, -5)\)

(D) contains the points \((-4,3)\) and \((5, -7)\).

(E) contains the points \((2, -1)\) and \((6, -4)\).
(F) contains the points \((4, -3)\) and \((-2, 6)\).

(G) contains the points \((-2, -1)\) and \((-1, -6)\).

(H) has \(x\)-intercept 2 and \(y\)-intercept 4.

(I) contains the points \((2, -1)\) and \((2, 4)\).
Example 2: Find the equation of straight line (linear function) such that

(A) is parallel to \( y = 2x - 3 \) and contains the point \((-1,2)\).

(B) is parallel to the line \( y = -3x + 5 \) and contains the point \((2,1)\).

(C) is parallel to the line \( 2x + y = 3 \) and contains the point \((0,5)\).

(D) is perpendicular to \( y = \frac{1}{3}x - 7 \) and contains the point \((2,-3)\).

(E) is perpendicular to \( y = -2x + 1 \) and contains the point \((1,2)\).

(F) is perpendicular to the line \( 4x + 3y = -3 \) and contains the point \((1,3)\).
EXERCISE 12

1. Find the slope and y-intercept of the following line.
   (A) $5x - 7y = 12$                    (B) $4x + 3y = 6$

2. Find the equation of the line such that
   (A) slope : $-4$ and contains a point $(2, -3)$
   (B) contains two points $(3, -2)$ and $(-1,1)$
   (C) contains two points $(-5, -2)$ and $(-5,1)$
   (D) is perpendicular to $y = -2x + 3$ and contains a point $(1,2)$
   (E) is parallel to $2x - y = 4$ and contains a point $(2,1)$
DAY 13: INTRODUCTION OF FUNCTION

A relation is any set of ordered pairs.

A function is a correspondence from a first set, called the domain, to a second set, called range, such that each element in the domain corresponds to exactly one element in the range:

- Vertical line test: it is a function if every vertical line intersect the graph in at most one point.
- If we can express this as \( y = \text{only one expression of } x \), then \( y \) is a function of \( x \).

Example 1: Determine whether the following is a function or not

(A) \{ (1,5), (2, 5), (3, 8), (4, 7) \}  
(B) \{ (4,1), (5, −8), (4, 3), (8, 2) \}

Example 2: Determine whether the following is a function or not

(A)  

(B)  

(C)  

Example 3: Determine whether the following is a function or not

(A) \( y = \frac{4 - 3x}{x + 1} \)  
(B) \( y = x^2 - 3x + 5 \)  
(C) \( x^2 + y^2 = 9 \)

(D) \( y = \sqrt{4 - 3x} \)  
(E) \( |y| = x - 3 \)  
(F) \( y^2 = x + 2 \)

Example 4: Let \( f = \{(2, −3), (5, 2), (−3, 5)\} \). Find \( f(5) \).
Example 5: Let \( f(x) = 2x - 3 \). Find

(A) \( f(5) \)  \hspace{1cm} (B) \( f(-4) \)  \hspace{1cm} (C) \( f(a + 1) \)

Example 6: Let \( f(x) = 4 - 3x \). Find

(D) \( f(2) \)  \hspace{1cm} (E) \( f(-3) \)  \hspace{1cm} (F) \( f(a - 2) \)

Example 7: Let \( f(x) = 3x^2 - 7x - 4 \). Find

(A) \( f(2) \)  \hspace{1cm} (B) \( f(-3) \)  \hspace{1cm} (C) \( f(-x) \)

Example 8: Let \( f(x) = 2x^2 - 3x + 5 \). Find

(A) \( f(4) \)  \hspace{1cm} (B) \( f(-3) \)  \hspace{1cm} (C) \( f(2x) \)
EXERCISE 13

1. Determine whether the following is a function or not.
   (A) \( y = 3x - 4 \)  
   (B) \( y^2 = x \)
   (C) \{ (2,3), (3,4), (4, -3) \}  
   (D) \{ (2, -3), (3, -4), (4, 3), (3, 2) \}

2. Find \( f(3) \) if \( f = \{ (-3, 2), (-1, 3), (1, 3), (2, 4), (3, 2) \} \).

3. Let \( f(x) = 4x - 5 \)
   (A) \( f(4) \)  
   (B) \( f(-2) \)  
   (C) \( f(x + 3) \)

4. Let \( f(x) = 3x^2 - 7x + 5 \)
   (A) \( f(4) \)  
   (B) \( f(-3) \)  
   (C) \( f(2x) \)
Example 1: Solve the inequalities and write the answer in the interval form

(A) $2x - 3 > 0$  
(B) $4x + 5 < 0$  
(C) $2x - 3 \geq x + 5$

(D) $6 - 2x \leq 0$  
(E) $8 - 4x \geq 0$  
(F) $x - 5 \leq 3x + 3$

Example 2: Find the domain of the following function

(A) $f(x) = 2x - 4x^2$  
(B) $y = \sqrt{12 - 3x}$  
(C) $y = \frac{x-2}{x-4}$

(D) $f(x) = 4x^4 - 5x + 8$  
(E) $y = \sqrt{3x - 15}$  
(F) $y = \frac{x-3}{x+2}$

(G) $f(x) = \sqrt{8 - 2x}$  
(H) $g(x) = \frac{x-2}{x+5}$  
(I)
Example 3: Let \( f(x) = x + 2 \) and \( g(x) = -6x + 12 \). Find

(A) \((f + g)(4)\)  
(B) \((f - g)(2)\)  
(C) \((f \cdot g)(1)\)  

(D) \((f + g)(x)\)  
(E) \((f - g)(x)\)  
(F) \((f \cdot g)(x)\)  

Example 4: Let \( f(x) = 2x + 3 \) and \( g(x) = 3x - 4 \). Find

(A) \((f + g)(2)\)  
(B) \((f - g)(3)\)  
(C) \((f \cdot g)(-2)\)  

(D) \((f + g)(x)\)  
(E) \((f - g)(x)\)  
(F) \(\left(\frac{f}{g}\right)(x)\)
EXERCISE 14

1. Solve the inequalities and write the answer in the interval form
   (A) $6x - 3 \leq 0$  
   (B) $4 - 5x < 0$

2. Find the domain of the following function.
   (A) $y = 3x - 6$  
   (B) $y = \frac{x}{x+1}$  
   (C) $y = \sqrt{x - 4}$

3. Let $f(x) = 3x - 4$ and $g(x) = 2x - 6$. Find
   (A) $(f + g)(3)$  
   (B) $(f - g)(-1)$  
   (C) $(f \cdot g)(2)$  
   (D) $(f + g)(x)$  
   (E) $(f - g)(x)$  
   (F) $\left(\frac{f}{g}\right)(1)$

4. Let $f(x) = x^2 - 2$ and $g(x) = \sqrt{x + 3}$. Find
   (A) $(f + g)(1)$  
   (B) $(f - g)(6)$  
   (C) $(fg)(-2)$
PRACTICE PROBLEMS FOR UNIT 2

1. Simplify the expression. Assume that all variables are positive.
   (A) $\sqrt{2}(3 - \sqrt{8})$
   (B) $(\sqrt{3} - \sqrt{5})^2$
   (C) $(2 - \sqrt{3})(3 + 2\sqrt{3})$
   (D) $\frac{3}{\sqrt{7} - \sqrt{5}}$
   (E) $\sqrt{4x^2 - \sqrt{9x^2} + 3\sqrt{25x^2}}$
   (F) $\sqrt{9x^2y - 3\sqrt{4x^2y} + 2\sqrt{16x^2y}}$

2. Find the midpoint and the distance between the following two points.
   (A) (2, 3) and (−4, 3)
   (B) (−3, 5) and (5, −7)

3. Simplify the following and write it as the corresponding radical form. Assume that all variables are positive.
   (A) $3^{3/2} \cdot 3^{2/3}$
   (B) $\frac{w^{5/6}}{w^{1/3}}$
   (C) $x^{1/2}(x^{1/3} + x^{1/4})$
   (D) $\frac{x^{2/3}}{x^{1/4}}$

4. Decide whether the following is a function or not
   (A)
   (B)
   (C)
   (D)
   (E) {(3, −2), (4, 2), (3, 5), (5, 4)}
   (F) $y = 2x - 3$
   (G) $y = x^2 - 3$
   (H) $x^2 + y^2 = 9$
   (I) $y = \frac{x+2}{x-4}$
   (J) $y = |x - 1|$

5. Find $f(−3)$ if $f(x) = 2x^2 - 5x + 3$

6. Find $f(−2)$ if $f(x) = x^2 + 2x - 3$

7. Find the domain of the following
   (A) $y = x^2 - 4x - 5$
   (B) $y = \sqrt{4 - 2x}$
   (C) $y = \frac{x-2}{x+3}$
   (D) $y = \frac{x-3}{x+6}$
8. Let \( f(x) = 3x - 2 \) and \( g(x) = -2x + 5 \)
   (A) \((f - g)(2)\)  \hfill (B) \((f \cdot g)(3)\)

9. Find the slope and y-intercept of the following.
   (A) \(2x - 3y = 5\)  \hfill (B) \(4x + 5y = 9\)

10. Find the linear line which satisfy the following
    (A) slope is 2 and y-intercepts \(-5\)
    (B) It passes through points \((2, -3)\) and \((4, 2)\)
    (C) It passes through points \((-1, 2)\) and \((2, 6)\)
    (D) It passes through point \((2, 1)\) and it is perpendicular to \(2x - y = 3\)
    (E) It passes through point \((1, 2)\) and it is parallel to \(3x - y = 2\)

11. Solve the equation
    (A) \(\sqrt{x^2 + 3x + 9} = x + 2\)  \hfill (B) \(\sqrt{x + 12} = x\)

12. Find \(f(3)\) if \(f = \{(2, -4), (3, 4), (4, 2), (5, 3), (51, -4)\}\)
Day 15: SYSTEM OF LINEAR EQUATIONS

Example 1: Solve the system of linear equations.

(A) \( x + y = 10 \)
    \( x - y = 6 \)

(B) \( 2x + 3y = 4 \)
    \( 4x - 3y = -10 \)

(C) \( 2x - 3y = 5 \)
    \( 3x + y = -9 \)

(D) \( x - 2y = 10 \)
    \( 4x + 7y = 25 \)

(E) \( 5x - 4y = -11 \)
    \( 3x + 2y = 11 \)

(F) \( y = x - 1 \)
    \( 5x - y = 13 \)

(G) \( x = 3y \)
    \( 3x + y = 1 \)

(H) \( 5x + 4y = 21 \)
    \( 4y = x + 15 \)
Example 2: Solve the system of linear equations.

(A) \( x - y = 8 \)
\( 3x - 3y = 8 \)

(B) \( 10x - 4y = -2 \)
\( -5x + 2y = 1 \)
EXERCISE 15

Example 1: Solve each system of linear equations by using substitution.

(A) \[ \begin{align*} 6x - y &= 11 \\ -2x - 3y &= -7 \end{align*} \]

(B) \[ \begin{align*} 2x - 3y &= -1 \\ x - y &= 1 \end{align*} \]

(C) \[ \begin{align*} 3x + y &= 9 \\ 5x - 4y &= -2 \end{align*} \]

(D) \[ \begin{align*} 4x + 3y &= -3 \\ 2x - y &= 11 \end{align*} \]

(E) \[ \begin{align*} y &= -2 \\ 4x - 3y &= 18 \end{align*} \]

(F) \[ \begin{align*} y &= 5x - 7 \\ -3x - 2y &= -12 \end{align*} \]

(G) \[ \begin{align*} 2x - 4y &= 2 \\ 3x - 6y &= 4 \end{align*} \]

(H) \[ \begin{align*} 6x - 4y &= 8 \\ 9x - 6y &= 12 \end{align*} \]
DAY 16: APPLICATION OF LINEAR/ LINEAR SYSTEM OF LINEAR EQUATIONS

Example 1: A car rental agency charges a weekly rate of $200 for a car and an additional charge of 5 cents for each mile driven. How many miles can you travel in a week for $500?

Example 2: Tom purchases a copy machine for $875. After 5 years, the machine will have to be replaced. Write a linear equation giving the value V of the equipment during 5 years it will be in use.

Example 3: Find the value of two numbers if their sum is 12 and their difference is 4.

Example 4: At a concert, 3 adult tickets and 2 child tickets cost $167 whereas 2 adult tickets and 1 child ticket cost $103. Find the price of an adult ticket.

Example 5: The school that Stefan goes to is selling tickets to a choral performance. On the first day of ticket sales the school sold 3 senior citizen tickets and 1 child ticket for a total of $38. The school took in $52 on the second day by selling 3 senior citizen tickets and 2 child tickets. Find the price of a senior citizen ticket and the price of a child ticket.
Example 6: A movie theater sells tickets for $9.00 each and seniors for $6.5. One evening the theater sold 600 tickets and took in $4597.5 in revenue. How many of seniors’ ticket were sold?

Example 7: A bank loaned out $100,000. Part of the money earned 10% per year, and the rest of it earned 6% per year. If the total interest received for one year was $7,000, how much was loaned at 10%?

Example 8: Flying to Kampala with a tailwind a plane averaged 158 km/h. On the return trip the plane only averaged 112 km/h while flying back into the same wind. Find the speed of the wind and the speed of the plane in still air.

Example 9: Mary wants to mix a drink containing 40% juice with a drink containing 10% juice to produce 10 gallons of a drink containing 25% juice. How much of each drink should she use?
EXERCISE 16

1. The price of a new phone is $165. Its value decreases by $6.75 each year. Find the phone value after 17 years.

2. A car rental agency charges a weekly rate of $250 for a car and an additional charge of 15 cents for each mile driven. How many miles can you travel in a week for $610?

3. The total price of 4 chips and 2 sodas is $15. The total price of 9 chips and 4 sodas is $32.75. Find the price of a chip.

4. A bank loaned out $50,000. Part of the money earned 10% per year, and the rest of it earned 6% per year. If the total interest received for one year was $4,480, how much was loaned at 10%?
DAY 17: QUADRATIC FUNCTION

Example 1: (a) graph each quadratic function by determining whether the graph opens up or down and by finding its vertex, axis of symmetry, y-intercept, and x-intercepts, if any. (b) Determine the domain and the range of the function. (c) Find maximum/minimum

(A) \( f(x) = -x^2 + 2 \)

(B) \( F(x) = -2(x + 3)^2 - 3 \)

(C) \( f(x) = 3(x - 4)^2 + 5 \)

(D) \( F(x) = x^2 + 2x - 3 \)

(E) \( f(x) = -4x^2 + 8x - 1 \)

(F) \( F(x) = 2x^2 + 8x + 3 \)

(G) \( f(x) = x^2 - 10x + 3 \)

(H) \( f(x) = -2x^2 + 12x + 5 \)
Example 2: Determine whether the following function has a maximum or minimum value.

(A) \( f(x) = -2(x - 3)^2 + 8 \)  

(B) \( f(x) = 3(x + 4)^2 - 5 \)

(C) \( f(x) = -x^2 + 10x - 4 \)  

(D) \( f(x) = 4x^2 - 8x + 3 \)

Example 3: Find the equation of quadratic function for which:

(A) Vertex is \((3, -2)\); contains the point \((1, 6)\)

(B) Vertex is \((4, -3)\); contains the point \((2, -1)\)

Example 4: Find the equation of quadratic function such that
EXERCISE 17

1. Using the following quadratic functions, answer the questions.
   
   (1) Find the vertex and vertex form.
   (2) Find the axis of symmetry
   (3) Find the domain.
   (4) Find the range.
   (5) Find the maximum or minimum.

   (A) \( y = 2(x + 3)^2 + 4 \)  
   (B) \( y = -3(x - 5)^2 + 2 \)  
   (C) \( y = 2x^2 - 10x + 9 \)  
   (D) \( y = -3x^2 + 9x + 2 \)  

2. Determine the quadratic function whose vertex is \((2, -3)\) and passes through a point \((-1, 2)\).
DAY 18: APPLICATION OF QUADRATIC FUNCTIONS

Example 1: Mary wants to make a rectangular flower bed. If she use 200 yards of fencing material, find the length and width of the largest flower bed.

Example 2: Tom has 120 feet of fencing available to enclose a rectangular field. One side of the field lies along the highway, so only three sides require fencing. Find the largest area.

Example 3: A ball is propelled vertically upward with an initial velocity of 20 meters per second. The distance \( s \) (in meters) of the object from the ground after \( t \) seconds is \( s(t) = -5t^2 + 20t \).

- (A) When will the ball be 15 meters above the ground?
- (B) When will it strike the ground?
- (C) Will the ball reach a height of 60 meters?

Example 4: A person standing close to the edge on the top of a 512-foot building throws a ball vertically upward. The quadratic function

\[
s(t) = -16t^2 + 64t + 512
\]

models the ball’s height above the ground, \( s(t) \), in feet, \( t \) seconds after it was thrown.

- (A) After how many seconds does the ball reach its maximum height?
- (B) What is the maximum height?
- (C) How many seconds does it take until the ball finally hits the ground?

Example 5: Tom, a manager of the ABAC Magazine Company, found out that when the unit price is \( x \) dollars, the revenue \( R \) in dollars is

\[
R(x) = -4x^2 + 2400x
\]

What unit price should be established to maximize the revenue?

Example 6: Tom has a rectangular window in his room such that its length is 3 feet more than the width. Find the dimensions of the window if the area of the opening is to be 154 square feet.
EXERCISE 18

1. A ball is thrown from the top of a building. Its height from the ground, \( h \) meters, after time \( t \) seconds, is given by
   \[ h = 160 + 20t - 5t^2. \]
   (A) When does the ball hit the ground?
   (B) When does the ball reach the maximum height?
   (C) What is the maximum height?

2. David has available 500 yards of fencing and wishes to enclose a rectangular area. Find the dimension of the rectangular lot if the area is to be maximum?

3. Tom wants to construct a rectangular flower bed on land bordered on one side by his house. It has 40 fts of fencing that is to be used to fence off the other three sides. What should be the dimension of the flower bed if the enclosed area is to be maximum? What is the maximum area?
DAY 19: RATIONAL EXPRESSION.

Example 1: Simplify the rational expression.

(A) \( \frac{36x^3}{42x^2} \)  

(B) \( \frac{16p^2}{28p} \)

(C) \( \frac{x-4}{3x^2-12x} \)  

(D) \( \frac{15x-3}{24} \)

(E) \( \frac{x-5}{x^2-10x+25} \)  

(F) \( \frac{x+6}{x^2+4x-12} \)

(G) \( \frac{x^2+8x+12}{x^2+3x-18} \)  

(H) \( \frac{x^2+3x-28}{x^2-49} \)

(I) \( \frac{93}{21x} \cdot \frac{34x}{51x} \)  

(J) \( \frac{79x}{25} \cdot \frac{85}{27x^2} \)

(K) \( \frac{x^2+4x-5}{x^2+7x+10} \cdot \frac{x+4}{x-1} \)  

(L) \( \frac{x^2-25}{3x+6} \cdot \frac{4x+8}{x^2+10x+25} \)

(M) \( \frac{x^2-2x}{x^2+2x-8} \cdot \frac{x^2+3x-4}{x^2+2x-3} \)  

(N) \( \frac{x^2-4x+3}{x^2+2x} \cdot \frac{x^2-2x-15}{x^2-9} \)
Example 2: Simplify the rational expression.

(A) \( \frac{10x}{9} \div \frac{13x^2}{16} \)  

(B) \( \frac{16x}{17} \div \frac{8x}{6} \)  

(C) \( \frac{4x}{x-6} \div \frac{4x}{8x-48} \)  

(D) \( \frac{7x^2}{7x^2+56x^2} \div \frac{2}{x^2+7x-8} \)  

(E) \( \frac{x^2-3x+2}{x^2+4x+3} \div \frac{x-1}{x+1} \)  

(F) \( \frac{x^2-4x+3}{x^2+x-12} \div \frac{x+2}{x+4} \)  

(G) \( \frac{2y^2-7y+3}{y^2-3y} \div \frac{2y-1}{y} \)  

(H) \( \frac{x^2+5x-6}{x^2-4x+3} \div \frac{x^2+7x+6}{x^2+6x-27} \)  

(I) \( \frac{2x^2+x-1}{x^2-16} \div \frac{2x^2-x}{x^2+3x-4} \)  

(J) \( \frac{3x+6}{x-1} \cdot \frac{x^3-1}{2x+4} \)
Example 3: Simplify the rational expression.

(A) \( \frac{3x-1}{x+3} + \frac{2x+3}{x+3} \)

(B) \( \frac{2x-5}{x-4} - \frac{x+3}{x-4} \)

(C) \( \frac{4x-5}{6x^2+30x} + \frac{x-1}{6x^2+30x} \)

(D) \( \frac{x+y}{18xy} - \frac{6x+y}{18xy} \)

(E) \( \frac{1}{4} + \frac{1}{x} \)

(F) \( \frac{1}{2} - \frac{5}{x} \)

(G) \( \frac{5}{y+2} + \frac{3}{y-1} \)

(H) \( \frac{5}{a+5} - \frac{2}{a+3} \)

(I) \( \frac{2}{x+3} + \frac{4}{x-3} \)

(J) \( \frac{6}{x-2} - \frac{3}{x+3} \)
Example 4: Simplify the rational expression.

(A) \( \frac{1}{x^2-49} + \frac{6}{x-7} \)

(B) \( \frac{4}{x+5} - \frac{3}{x^2+10x+25} \)

(C) \( \frac{x}{x^2-5x+6} + \frac{x+1}{x^2-2x-3} \)

(D) \( \frac{2x}{x^2-4x+4} - \frac{1}{x^2-4} \)
EXERCISE 19

1. Simplify
   (A) \( \frac{x+4}{x^2+3x-4} \)  
   (B) \( \frac{6x^2-3x}{4x^2-1} \)
   (C) \( \frac{2x+5}{3x-2} \) \( \frac{15x-10}{2x} \)
   (D) \( \frac{x^2-4x+3}{x^2+2x} \) \( \frac{x^2-2x-15}{x^2-9} \)
   (E) \( \frac{7x^2y}{3ax} \) \( \frac{14ay}{a^3} \)
   (F) \( \frac{2x^2+x-1}{x^2-16} \) \( \frac{2x^2-x}{x^2+3x-4} \)

2. Simplify
   (A) \( \frac{4}{x} + \frac{3}{x+1} \)
   (B) \( \frac{1}{x+2} + \frac{1}{x-2} \)
   (C) \( \frac{1}{x^2-49} + \frac{6}{x-7} \)
   (D) \( \frac{3}{x+7} \) \( \frac{2}{x-8} \)
   (E) \( \frac{4}{x+2} \) \( \frac{5}{3x-4} \)
   (F) \( \frac{4}{x+5} \) \( \frac{3}{x^2+10x+25} \)
Example 1: Solve the equation:

(A) \( x + \frac{1}{x} = 2 \)

(B) \( \frac{x-1}{4} = \frac{x}{x+3} \)

(C) \( \frac{2x+1}{3x+4} = \frac{x}{3x-2} \)

(D) \( \frac{x-2}{x} = \frac{x}{x-1} \)

(E) \( \frac{3}{x+4} = \frac{x}{1+2x} \)

(F) \( \frac{1}{2x-1} + \frac{1}{x+1} = \frac{1}{(2x-1)(x+1)} \)

(G) \( \frac{1}{x+2} + \frac{1}{2x-1} = \frac{1}{(x+2)(2x-1)} \)

(H) \( \frac{3}{x^2+x} + \frac{2x}{x^2-x} = \frac{4}{x^2-1} \)

(I) \( \frac{2}{x-2} + \frac{x-3}{x-4} = 2 \)

(J) \( \frac{x}{x-2} + \frac{x+7}{x+2} = 5 \)
Example 2: Working alone, Tom can dig a 10 ft by 10 ft hole in five hours. John can dig the same hole in six hours. How long would it take them if they worked together?

Example 3: It takes Mary ten hours to clean an attic. Tom can clean the same attic in seven hours. Find how long it would take them if they worked together.

Example 4: Working alone, Mary can oil the lanes in a bowling alley in five hours. Tom can oil the same lanes in nine hours. If they worked together how long would it take them?

Example 5: A boat goes 7 mph in still water. It takes as long to go 20 mi upstream as 50 mi downstream. Find the rate of the current.

Example 6: One pipe can fill a swimming pool in 9 hours and another can fill it in 12 hours. How long will it take the two pipes working together to fill the pool $\frac{2}{3}$ fill?

Example 7: Andrew can paint the neighbor’s house 6 hours more fast than Bailey. The year Andrew and Bailey worked together, it took them 4 hours. How long it would it take each to paint the house?
EXERCISE 20

1. Simplify
   (A) \[ \frac{x+1}{2} = \frac{8}{x+1} \]
   (B) \[ \frac{3x-1}{2x+5} = \frac{x-3}{x+4} \]

   (C) \[ \frac{1}{x-3} + \frac{1}{x+3} = \frac{5}{8} \]
   (D) \[ \frac{3}{7x-2} - \frac{2}{7x+3} = \frac{3}{4} \]

2. Mary can pour a large concrete driveway in six hours. Tom can pour the same driveway in seven hours. Find how long it would take them if they worked together.
PRACTICE PROBLEMS FOR UNIT 3

1. Solve the following system of linear equations.
   (A) \(-2x + 3y = 7\)  
   \[\begin{aligned} \quad x + 5y &= 3 \end{aligned}\]  
   (B) \(3x + 5y = 1\)  
   \[\begin{aligned} 4x + 7y &= 2 \end{aligned}\]  
   (C) \(y = x + 8\)  
   \[\begin{aligned} 6x - y &= 7 \end{aligned}\]  
   (D) \(2x - y = 11\)  
   \[\begin{aligned} 3x - 4y &= 29 \end{aligned}\]  
   (E) \(x^3 - y^2 = 1\)  
   \[\begin{aligned} 6x - 9y &= 18 \end{aligned}\]  
   (F) \(3x - 4y = 12\)  
   \[\begin{aligned} 6x - 8y &= 20 \end{aligned}\]

2. The total cost of 4 cutters and 2 glue sticks is $13. The total cost of 7 cutters and 5 glue sticks is $25. Find the price of a cutter and the price of a glue stick.

3. A movie theater sells tickets for $7.00 each and children for $4. One evening the theater sold 140 tickets and took in $731 in revenue. How many of children’ ticket were sold?

4. A bank loaned out $50,000. Part of the money earned 8% per year, and the rest of it earned 5% per year. If the total interest received for one year was $2,950, how much was loaned at 8%?

5. (a) graph each quadratic function by determining whether the graph opens up or down and by finding its vertex, axis of symmetry, y-intercept, and x-intercepts, if any. (b) Determine the domain and the range of the function. (c) Find maximum/minimum
   (A) \(f(x) = -2(x + 4)^2 + 5\)  
   (B) \(f(x) = \frac{1}{2}(x - 3)^2 - 2\)  
   (C) \(f(x) = -x^2 - 4x + 6\)  
   (D) \(f(x) = 2x^2 - 8x + 1\)  
   (E) \(f(x) = 2x^2 - 6x + 3\)  
   (F) \(f(x) = -4x^2 - 8x - 5\)

6. Find the quadratic equation which satisfies the following conditions
   (A) Its vertex is \((2, -3)\) and it passes through a point \((1, 4)\)
   (B) Its vertex is \((-4, 5)\) and it passes through a point \((-2, 3)\)

7. A ball is thrown upward. The height \(H\) of a ball in feet after \(t\) seconds in \(H(t) = -16t^2 + 192t\).
   (A) When does the ball reach the maximal height?
   (B) Find the maximal height.
   (C) When is the ball 288 ft above the ground?
   (D) How long does it take the ball to hit the ground?

8. Suppose that the ABAC company discovered that when the unit price is \(x\) dollars, the revenue \(R\) in dollars is \(R(x) = -3x^2 + 3300x\)
   (A) What unit price should be established to maximize the revenue?
   (B) What is the maximum of revenue?
9. ABAC decide to make a rectangular flower bed in front of Science building by using 640 yards of fencing available. Find the length and width of the flower bed when it has the largest area.

10. ABAC decide to make a rectangular parking lot by using 645 yards of fencing available. One side of the parking lot lies along the highway, so only three sides require fencing. Find the largest area.

11. The length of a rectangle is 6 cm greater than its width. The area of the rectangle is 27 square centimeters. Find the length of the rectangle.

12. Simplify the expressions
   (A) \(\frac{3}{x+2} - \frac{2}{x-3}\)
   (B) \(\frac{2}{x-3} + \frac{3}{x+5}\)
   (C) \(\frac{4}{x+2} - \frac{5}{7x-3}\)
   (D) \(\frac{2}{4x-1} + \frac{3}{3x+2}\)
   (E) \(\frac{x^2+x-6}{x^2+4x-5} \cdot \frac{x^2-3x+2}{x^2-2x}\)
   (F) \(\frac{x^2-4}{x+2} \div \frac{x^2+2x-8}{x+5x+4}\)
   (G) \(\frac{2x^2-7x+3}{x^2-2x-3} \cdot \frac{x^2-1}{2x^2-x-1}\)
   (H) \(\frac{y^2-4y+4}{y^2-2y} \div \frac{y^2+4y-12}{y^2+7x+6}\)

13. Solve the equation
   (A) \(\frac{5+x}{3} = \frac{2-x}{6}\)
   (B) \(\frac{2x+1}{3x+4} = \frac{x}{3x-2}\)

14. Working alone, it takes Keith 11 hours to harvest a field. Tom can harvest the same field in 16 hours. Find how long it would take them if they worked together.
Example 1: Let $f(x) = 3x - 2$ and $g(x) = 2x + 5$. Find the following:

(A) $(f \circ g)(2)$
(B) $(g \circ f)(2)$
(C) $(f \circ g)(-3)$
(D) $(g \circ f)(-1)$
(E) $(f \circ g)(x)$
(F) $(g \circ f)(x)$

Example 2: Let $f(x) = 2x - 5$ and $g(x) = 3 - x$. Find the following:

(A) $(f \circ g)(3)$
(B) $(g \circ f)(1)$
(C) $(f \circ g)(-3)$
(D) $(g \circ f)(-2)$
(E) $(f \circ g)(x)$
(F) $(g \circ f)(x)$
Example 3: Decide whether the following is a one to one function or not.

(A) \( f(x) = |x + 5| - 2 \)

(B) \( y = x^3 - 2 \)

(C) \( y = x^2 + 2x - 3 \)

(D) \( y = \frac{x-1}{x+2} \)

(E) \( x^2 + y^2 = 9 \)

Example 4: Find the inverse of the following function

(A) \( f(x) = 3x - 5 \) \hspace{2cm} (B) \( f(x) = 2x + 4 \)

(C) \( f(x) = -2x + 3 \) \hspace{2cm} (D) \( f(x) = \sqrt[3]{x + 2} \)

(E) \( f(x) = \sqrt[3]{x - 3} \) \hspace{2cm} (F) \( f(x) = x^3 + 2 \)
EXERCISE 21.

1. Let \( f(x) = 5x - 4 \) and \( g(x) = 2x - 3 \)
   (A) \( (f \circ g)(2) \)  
   (B) \( (g \circ f)(-3) \)

   (C) \( (f \circ g)(x) \)  
   (D) \( (g \circ f)(x) \)

2. Decide whether the following is a one to one function or not.
   (A) \( y = x^2 - 4x + 5 \)  
   (B) \( y = x^3 - 2 \)

   (C) \( y = |x + 1| \)  
   (D) \( y = 3x - 2 \)

3. Find the inverse function of \( f \).
   (A) \( f(x) = 3x - 6 \)  
   (B) \( f(x) = \sqrt[3]{x - 1} \)
Example 1: Write each equation in its equivalent exponent form
(A) \( 2 = \log_5(x) \)  
(B) \( 3 = \log_b(64) \)  
(C) \( \log_5(b) = a \)  
(D) \( \log_3(x - 3) = r \)

Example 2: Write each equation in its equivalent logarithmic form.
(A) \( 12^2 = x \)  
(B) \( e^{12} = h \)  
(C) \( a^5 = b \)  
(D) \( (5 - x)^4 = b \)

Example 3: Evaluate each of the following logarithms.
(A) \( \log_2(16) \)  
(B) \( \log_5(7) \)  
(C) \( \log_2(10) \)  
(D) \( \log_7(6) \)

Example 4: Consider the below function. Answer the following questions.
(A) \( f(x) = 3^x + 2 \)

□ Domain: ____________
□ Range: ____________
□ Horizontal Asymptote: ____________
□ \( y \)-intercepts: ____________

(B) \( g(x) = \left(\frac{1}{2}\right)^x - 3 \)

□ Domain: ____________
□ Range: ____________
□ Horizontal Asymptote: ____________
□ \( y \)-intercepts: ____________

(C) \( f(x) = \log_2 x \)

□ Domain: ____________
□ Range: ____________
□ Vertical Asymptote: ____________
□ \( x \)-intercepts: ____________

(D) \( g(x) = \log_\frac{1}{3} x \)

□ Domain: ____________
□ Range: ____________
□ Vertical Asymptote: ____________
□ \( x \)-intercepts: ____________
Example 5: Solve the equation

(A) $3^{x+1} = 27$  
(B) $2^{x-3} = 16$

(C) $4^{5x-7} = 8$  
(D) $9^{2x+5} = 27$

(E) $9^{5x-2} = 27^{x+1}$  
(F) $4^{3x-2} = 8^{3-x}$

(G) $5^{x-2} = \frac{1}{125}$  
(H) $(\frac{1}{2})^x = 32$

(I) $4^{x} = 2^{x+2}$  
(J) $e^{x^2+6} = e^{5x}$

(K) $\left(\frac{3}{2}\right)^{x+2} = \left(\frac{4}{9}\right)^3$  
(L) $e^{x^2-3} = e^{2x}$
EXERCISE 22

1. Write each equation in its equivalent exponent form
   (A) $x = \log_a (b)$  
   (B) $y = \log_b (x + 5)$

2. Write each equation in its equivalent logarithmic form.
   (A) $(x + 2)^2 = y$  
   (B) $a^{x+3} = y$

3. Solve the equation
   (A) $3^{5x-4} = 81$  
   (B) $4^{3x-7} = 8^{x-6}$
   (C) $2^{x+4} = \frac{1}{16}$  
   (D) $\left(\frac{3}{2}\right)^{2x-3} = \frac{9}{4}$
Example 1: Use logarithmic properties to expand each expression as much as possible. Assume that all variables are positive.

(A) \( \log_a (u^6 v^5) \)  
(B) \( \log_b (x^2 \sqrt{y}) \)

(C) \( \ln \left( \frac{x}{w y^4} \right) \)  
(D) \( \log \left( \frac{x^3 y}{w^2} \right) \)

Example 2: Write each expression as a single logarithm.

(A) \( \log_{10} x + \log_{10} y \)  
(B) \( 3 \ln(x) - 2 \ln(y) \)

(C) \( 3 \log(x) - 4 \log(t) \)  
(D) \( 4 \log(y) + \log(x^4 y^2) \)

(E) \( 2 \ln x - 3 \ln y + 4 \ln z \)  
(F) \( 5 \log(x) - 3 \log(y) - 2 \log(z) \)

Example 3: Evaluate each of the following logarithms.

(A) \( \log_2 (16) \)  
(B) \( \log_5 (7) \)

(C) \( \log_2 (10) \)  
(D) \( \log_7 (6) \)
Example 4: Solve the equation:

(A) \( \log_4 (x - 3) = \log_4 (4) \)

(B) \( \log_3 (x + 1) = \log_3 (3x + 7) \)

(C) \( \ln (x + 3) = \ln (2x) \)

(D) \( \log (5x - 4) = \log (3x + 7) \)

(E) \( \log_2 (x + 5) = 3 \)

(F) \( \log_3 (2x - 5) = 2 \)

(G) \( \log_2 (6x + 2) = 4 \)

(H) \( \log_6 (4x - 2) = 1 \)

(I) \( \log (x + 3) = 2 \)

(J) \( \log_5 (3x - 2) = 2 \)

(K) \( \log (x) + \log (x - 21) = 2 \)

(L) \( \log_2 (x - 2) + \log_2 (x + 4) = 4 \)
EXERCISE 23

1. Use logarithmic properties to expand each expression as much as possible. Assume that all variables are positive.
   (A) \( \log_a(x^3y^4) \)
   (B) \( \log_b \left( \frac{x^5}{y^7} \right) \)

2. Write each expression as a single logarithm.
   (A) \( 5 \log_{10} x + 9 \log_{10} y \)
   (B) \( 4 \ln(x) - 5 \ln(y) \)

3. Solve the equation.
   (A) \( \log_2(4x - 5) = \log_2(2x + 4) \)
   (B) \( \ln(x^2) = \ln(2x + 3) \)

   (C) \( \log_2(3x - 2) = 4 \)
   (D) \( \log(2x - 1) = 2 \)
1. Rewrite the following in logarithmic form
   
   (A) \( 2^4 = 16 \) \quad (B) \( 3^2 = 9 \) 
   
   (C) \( x^a = b \) \quad (D) \( (x - 2)^a = y \) 

2. Rewrite the following in exponential form
   
   (A) \( 3 = \log_2(8) \) \quad (B) \( 2 = \log_5(25) \) 
   
   (C) \( a = \log_2(x) \) \quad (D) \( x = \log(z) \) 

3. Evaluate the following. (Give an approximation to four decimal places.)
   
   (A) \( \log_2(5) \) \quad (B) \( \log_6(11) \) 

4. Find \( f^{-1}(x) \) for the one-to-one function \( f(x) \).
   
   (A) \( f(x) = 3x - 6 \) \quad (B) \( f(x) = 4 - 2x \) 
   
   (C) \( f(x) = x^3 - 8 \) \quad (D) \( f(x) = x^3 + 2 \) 
   
   (E) \( f(x) = \sqrt[3]{x} + 4 \) \quad (F) \( f(x) = \sqrt[3]{x} - 5 \) 

5. Decide whether the following is a one to one function or not.
   
   (A) \( y = x^3 + 2 \) \quad (B) \( y = x^2 - 4 \) 
   
   (C) \( y = \frac{x-1}{x+2} \) \quad (D) \( y = x^3 - 9x \) 
   
   (E) \( y = \sqrt{x} + 2 \) \quad (F) \( x^2 + y^2 = 9 \) 

6. Solve the following equations.
   
   (A) \( 3^{2x-1} = 81 \) \quad (B) \( 9^{2x-8} = 27^{x-4} \) 
   
   (C) \( 25^{2x-6} = \left( \frac{1}{125} \right)^x \) \quad (D) \( x = \log_4(8) \) 
   
   (E) \( \log_3 x = 2 \) \quad (F) \( \log_2(6x - 1) = 3 \) 
   
   (G) \( \log(x - 3) = 2 \) \quad (H) \( \log_x(36) = -2 \) 

7. If the values of \( \log_a(2) = 0.2038 \) and \( \log_a(3) = 0.3230 \), find the following
   
   (A) \( \log_a(24) \) \quad (B) \( \log_a(\sqrt{3}) \) 
   
   (C) \( \log_a\left(\frac{3}{2}\right) \) \quad (D) \( \log_a\left(\frac{6}{3}\right) \) 

8. The exponential growth model \( A = 30e^{0.15t} \) describes the population of a city in the United States, in thousands, \( t \) years after 1994. Use this model to solve the following:
   
   (A) What was the population of the city in 2000?
   
   (B) What will the population of the city be in 2005?
SOLUTIONS
Day 1
1. (A) 3 (B) 4 (C) 5 (D) 7 (E) 8 (F) – 6
2. (A) $\sqrt{10} (B)$ $\sqrt{6} (C)$ $\sqrt{10} (D)$ $2\sqrt{3} (E)$ $\sqrt{7} (F)$ $\sqrt{13}$ 
   (G) $4\sqrt{3} (H) 10 \sqrt{2} (I) 4 \sqrt{2}$
3. (A) $-7\sqrt{7} (B) -4 \sqrt{5} (C) \sqrt{3} (D) 9 \sqrt{2} (E) -84 (F) 22 \sqrt{2}$
   (G) $23 \sqrt{3} (H) 18 \sqrt{5} (I) -3 \sqrt{2} -6 \sqrt{5} (J) 3 \sqrt{2} (K) \frac{\sqrt{7}}{2} (L) \frac{\sqrt{12}}{4}$
4. (A) $5 \sqrt{5} (B) 6 \sqrt{6} (C) 4 \sqrt{5} (D) 4 x \sqrt{2} (E) 3 x y^2 \sqrt{3}$
   (F) $-10 x \sqrt{2} (G) 12 x \sqrt{10} (H) 3 x y \sqrt{5} (I) 5 x y^2 \sqrt{3}$

Exercise 1
1. (A) 11 (B) – 24 (C) $2 \sqrt{7} (D) \sqrt{13} (E) 46 \sqrt{5} (F) -42 \sqrt{2}$
   (G) $-16 \sqrt{2} (H) 20 \sqrt{2} + 14 \sqrt{5} (I) \frac{\sqrt{3}}{3} (J) \frac{3 \sqrt{3}}{4}$
2. (A) $2 x y \sqrt{7} (B) 36 x \sqrt{2} (C) -30 \sqrt{6} x$

Day 2
1. (A) $5 + 2i$ (B) $-3 + 4i (C) 1 - 2i (D) -3 + 3i (E) -8 + 12i$
   (F) $11 + 2i (G) 13 (H) 5 - 12i (J) -2 \sqrt{3} (K) 2 \sqrt{11} (L) 6 \sqrt{2} i (M) -i (N) -1$
2. (A) $i (B) -i (C) -3i (D) 7i (E) \frac{8}{41} (F) \frac{10}{41} (G) \frac{13}{2} + \frac{13}{2} i$
   (H) $\frac{4}{13} - \frac{7}{13} i (I) \frac{9}{4} - \frac{8}{5} i$

Exercise 2
1. (A) $-4 - 3i (B) 8 (C) 41 (D) -5 - 31i (E) 9 - 40i$
   (F) $-40 - 42i (G) -\frac{1}{10} - \frac{4}{5} i (H) -3 - 5i (I) -i (J) i$

Day 3
1. (A) $-3x^2 + 19x - 7 (B) 3x^2 - 4x (C) 20ax - 15ay$
   (D) $15x^2 - xy - 6y^2 (E) 4x^2 - 9y^2 (F) 9x^2 - 12x + 4$
   (G) $x^2 - 6xy + 9y^2 (H) 9x^2 - 30x + 25$
2. (A) $2(5c - 6s) (B) -5m^2x(x^2 + 2m^2) (C) 12xy(2x - 3y^2)$
   (D) $x^2(2x^2 - 5x + 3) (E) m^3(x + m^2y + 3m^2z)$
   (F) $5m - 4(a + b) (G) (y + 1)(x^2 - 5) (H) (b + 2)(a + c)$
3. (A) $(a + b)(x - y) (B) (2p + 3q)(5x + 4y)$
   (C) $(4x - 7y)(9a - b) (D) (x - 2)(x^2 - 5)$
   (E) $(2-a)(2-x)(F)(x^2 + 6)(x+3)$
4. (A) $\frac{a - \sqrt{b}}{3} (B) \frac{2 + \sqrt{11}}{4} (C) x (D) 3x^2 - 2(E) 2x^2y^2 - 3$
   (F) $4a^2b^2 + \frac{2a}{b} - a (G) -x + 1 (H) 2x^2 - 2x + 12$

Exercise 3
1. (A) $2x^2 - 7xy + 15y^2 (B) 15x^2 - 26xy + 8y^2$
   (C) $16x^2 - 52x + 49$
2. (A) $4xy(3xy^2 - 4x^2) (B) 2x^2(x^3 - 4x^2 + 7)$
   (C) $(a - 3)(x - t)$
3. (A) $(a - 1)(x - 3y) (B) 2(2x^2 + 1)(3x - 4)$
   (C) $(x^2 + 4)(x + 3)(D)(x^2 + 5)(x - 2)$
4. (A) $2x (B) 4a - 3$

Day 4
1. (A) $(x + 1)(x + 2) (B) (x - 1)(x - 6) (C)(x - 2)(x - 5)$
   (D) $(x + 1)(x - 9) (E)(x - 6)(x - 7) (F)(x + 4)(x + 11)$
   (G) $(x + 3)(x + 7) (H)(x + 3)(x - 4) (I)(x + 5)(x - 6)$
   (J) $(x - 4)(x + 9) (K)(x - 6)^2 (L)(x - 6)(x - 8)$
   (M) $(x - 4)(x + 6) (N)prime (O)(x + 7)(x - 8)$
   (P) $(x + 3)(x - 12)(Q)(x - 3)(x + 3) (R)(x - 5)(x + 5)$
2. (A) $(x - y)(x - 2y) (B)(x - 2y)(x + 3y)$
   (C) $(x + 2y)(x - 4y) (D)(x + 3y)(x + 6y)$
3. (A) $5x(x + 2)(x - 3)(B)(a + 1)(x + 1)(x - 3)$

Exercise 4
1. (A) $(x + 2)(x - 6) (B)(x - 2)(x - 7) (C)(x + 2)(x + 8)$
   (D) $(x + 2)(x + 13) (E)(x + 4)(x - 3) (F)(x - 5)(x - 10)$
   (G) $(x + 5)(x + 4) (H)prime$
2. (A) $(x + y)(x - 5y) (B)(x + 2y)(x - 10y)$
3. (A) $2(x + 5)(x + 6) (B)x(x - 1)(x - 6)$

Day 5
1. (A) $(2x + 1)(x - 1) (B)(3x + 7)(x + 1)$
   (C) $(2x + 5)(x + 2) (D)(3x + 1)(x - 7)$
   (E) $(2x - 1)(3x + 1) (F)(2x + 1)^2 (G)(4x - 9)(x + 1)$
   (H) $(3x - 1)(5x + 2) (I)(3x - 1)^2 (J)(5x + 2)(x + 2)$
   (K) $(2x - 3)^2 (L)(3x + 4)^2$
2. (A) $(2x - 3)(x + 5) (B)(2x + 1)(3x - 1)$
   (C) $(2x - 1)(5x - 2) (D)(3x + 1)(x - 2)$
   (E) $(2x + 3)(3x + 2) (F)(2x + 3)^2$
   (G) $(3x + 5y)(x - 2y) (H)(4x - y)(3x - y)$
   (I) $7x(3x + y)(x - 2y) (J)(a + 1)(2x - 1)(x - 1)$
**EXERCISE 5**

1. \((A)(2x^2 - 3x + 3)(B)(3x^2 - 2x - 2)(C)(3x^2 - 4)(2x - 3)
   (D)(3x^2 - 5)(x + 1) (E)(2x + 1)(x + 5) (F)(2x - 1)(4x + 3)

2. \((A)(2x + y)(x^2 + 2y) (B)(3x + y)(x - y)
   (C)x(2x - 1)(x - 3)(D)x(3x - 1)(x - 1)\)

**Day 6**

1. \((A)(x - 5)^2(B)(x + 2)^2(C)(x - 4)^2(D)(x + 3)^2
   (E)(4x - 5)^2 (F)(2x - 1)^2 (G)(x - 4)(x + 4)
   (H)(5 - x)(5 + x) (I)(2x - 3)(2x + 3) (J) Prime
   (K)(5x - 3)(5x + 3) (L)(3x - 4y)(3x + 4y)\)

2. \((A)(x - 1)^2(x^2 + x + 1) (B)(x + 2)(x^2 - 2x + 4)
   (C)(x - 3)(x^2 + 3x + 9) (D)(x + 4)(x^2 - 4x + 16)
   (E)(2x - y)(4x^2 + 2xy + y^2)
   (F)(3x + 2y)(9x^2 + 6xy + 4y^2) (G)(x - 2)(x + 2)(x^2 + 4)
   (H)(x - 1)(x^2 + x + 1)(x + 1)(x^2 - x + 1)\)

**EXERCISE 6**

1. \((A)(x - 7)(x + 7) (B)(x - 3y)(x + y)(C)(x - 6)^2
   (D)(x + 9)^2(E)(2x - 5)^2 (F)(3x - 7)^2
   (G)(2x - y)(4x^2 + 2xy + y^2) (H)(3x + 2)(9x^2 - 6x + 4)\)

**Day 7**

1. \((A) \pm 4 (B) \pm 3i (C) \pm 6 (D) \pm 7i (E) \pm 3 \frac{1}{2} (F) \pm 4 \frac{1}{5}
   (G)5 \pm 2\sqrt{3} (H) - 3 \pm 4\sqrt{2}\)

2. \((A) 0, 3 (B)0, \frac{1}{2}\)

3. \((A) -3, \frac{1}{2} (B)2, 4 (C) -1, 6 (D) -2, 4 (E) 3, 4 (F) \frac{1}{2}, 3
   (G) - \frac{1}{2}, \frac{2}{3} (H) \frac{1}{3}, -2 (I) \frac{-1 + \sqrt{3}}{2} (J) \frac{-1 - \sqrt{3}}{2} (K) \frac{3 + \sqrt{3}}{2}
   (L)3 \pm \sqrt{10}\)

4. \((A) \frac{4}{3} (B)1, -3 (C)0.4 (D)0.3, -2 (E)0.4, -5 (F)0, 3, -1
   5. 9 cm\)

**EXERCISE 7**

1. \((A) \pm 4i (B)2 \pm 2\sqrt{3} (C) - 5 \pm 4\sqrt{2} (D)0, -4 (E) \frac{3 \pm \sqrt{5}}{2}
   (F) \frac{3 \pm \sqrt{7}}{4} (G) \frac{3 \pm \sqrt{7}}{2} (H)3 \pm 2\sqrt{3} (I) - \frac{3}{2}, -1 (J)2 \pm i
   (K) \frac{3 \pm \sqrt{5}}{2} (L)\frac{3 \pm \sqrt{7}}{2}\)

2. \((A)0, 1, 4 (B)0, \frac{1}{2}, 4\)

**PRACTICE PROBLEMS FOR EXAM 1**

1. \((A) \frac{2}{5} + \frac{4}{5} (B)1 - i (C) i (D) - 1\)

2. \((A) - 3 + 6i (B)18 - 6i (C) - 1 - 17i (D) - 33 - 56i\)

3. \((A) 13x + 10y (B) - 12x^5 + 21x^4 + 15x^3
   (C) 6k^2 - 9k - 6 (D) 5p^5 - 2p^4 - 3p^3 + 25p^2 + 15p
   (E) 36m^2 - 25 (F) 4r^2 + 20rt + 25t^2 (G) 4b - 3a
   (H)4x - 5\)

4. \((A)(p + q)(p + 4) (B)(q - 3)(q + 9) (C)(y - 8)(y - 5)
   (D)(x - 4)(x + 7) (E)(r - 8)(r + 7)
   (F)(x - 6)(x + 4) (G)(x - 2)(3x + 1)
   (H)(4x - 9)(2x + 1) (I)(2x + 5)(x + 1) (j)(3x + 5)^2
   (K)8p(p - 5)(p + 2) (L)3x^2(x + 2)(x + 8)
   (M)(7y - 5w)(7y + 5w) (N) prime (O)(6x - 5)(6x + 5)
   (P)(x - 4)(x + 4)(x + 16)
   (Q)(x - 3)(x + 3)(x^2 + 9) (R)(x + 2)(x^2 - 2x + 4)\)

5. \((A)[4, \pm \sqrt{2}] (B)[0,8] (C)[3, 5] (D)[6]
   (E) \{\pm \frac{8}{3}\} (F)[3 \pm 2\sqrt{3}] (G) \{1+i\} (H) \{\frac{1+i\sqrt{3}}{4}\}
   (I) \{5, -1\} (J) \{3 \pm 4i\}\)

6. \((A) 8\sqrt{2} (B) 2\sqrt{7} (C) 6\sqrt{3} (D) 8\sqrt{5} (E)\sqrt{3} (F)2\sqrt{7}\)

7. Length = 10; width = 4

**Day 8**

1. \((A) 2 (B) - 3C 3\sqrt{3} (D)2\sqrt{3} (E)3\sqrt{3}\sqrt{3}\sqrt{3}(F)2\sqrt{3}\)

2. \((A) \frac{2}{3} (B) \frac{\sqrt{3}}{3} (C)18\sqrt{3} (D)2\sqrt{3} + 4\sqrt{5}(E) - 6\sqrt{3} - 9\sqrt{2}
   (F) - 5\sqrt{3} + 3\sqrt{2} (G) - 16 + 12\sqrt{3} (H) - 30 + 13\sqrt{5}
   (I)2 (J)15 - 2\sqrt{10} (K)28 - 10\sqrt{3} (L)21 - 6\sqrt{10}\)

3. \((A)\sqrt{5} + 2(B) \frac{10 - 2\sqrt{10}}{15} (C)6 + 3\sqrt{3} + 2\sqrt{3} + \sqrt{5}
   (D) \frac{\sqrt{3} + \sqrt{7}}{4}\)

4. \((A)\sqrt{11} \sqrt{3} (B)6\sqrt{2} \sqrt{3} (C)5; \left(\frac{1}{2}, 5\right) (D)\sqrt{85} \left(\frac{7}{2}, -4\right)\)

**EXERCISE 8**

1. \((A)2xy\sqrt{4}y^2 (B)4x\sqrt{4}y (C)2x\sqrt{4}y^2\)

2. \((A)1 (B)22 - 5\sqrt{2} (C)13 - 2\sqrt{30} (D) \frac{2\sqrt{7}}{9}\)

3. \((A)\frac{\sqrt{5}}{5} (B) \frac{20 - 5\sqrt{2}}{14}\)

4. \((A)2\sqrt{13} (B)\sqrt{65}\)
Day 9

1. (A) \( y = 5 (C) 2 \) (D) \( 7 \sqrt{2} (E) 2 \sqrt{4} (F) x^2 \sqrt{x} \) 
   \( (H) 2x \sqrt{y} \) (I) \( 2x^2 \sqrt{y} \) (J) \( 33x (K) \frac{21}{4} \) (L) \( 6x \sqrt{y} \)

2. (A) \( \sqrt{2} (B) \frac{1}{\sqrt{49}} (C) \sqrt{x^2} \)

3. (A) \( \frac{x^{14}}{3^3} (B) \frac{8x^{12}}{y^6} (C) \frac{y}{x^6} \) (D) \( x^{11/6} (E) x^{3/2} (F) x^{1/2} (G) x^{1/2} \) 
   \( (H) \frac{a^{1/2}}{b^{1/2}} (I) a^{5/12} + a^{5/2} (J) x^{17/12} - x^{13/12} (K) x^{5/6} \) 
   \( (L) \frac{x^{12/5}}{y^4} \)

EXERCISE 9

1. \( (A)x^{1/3} (B)x^{3/4} \)

2. \( (A) \frac{\sqrt{x}}{5} (B)\sqrt{x} \)

3. \( (A)x^{1/6} y^{5/9} (C) a^{1/2} - a^{4/5} \)

Day 10

1. (A) \( 3 \) (B) \( 2 \) (C) \( 3 \) (D) \( 3 \) (E) \( 6 \) (F) \( 6 \) (G) \( 3 \) (H) \( 9 \)
   \( (I) \frac{1}{2} (J) 7 (K) 4 \)

EXERCISE 10

1. \( (A) 2 \) (B) \( 3 \) (C) \( 4 \) (D) \( 5 \)

Day 11

1. \( v(x) = 2 \)

2. (A) \( \text{slope} = 3 y - \text{int:} -5 \) (B) \( \text{slope} = -\frac{4}{3} y - \text{int:} 2 \)

(C) \( \text{slope} = 3 y - \text{int:} 5 \) (D) \( \text{slope} = \frac{2}{5} y - \text{int:} 0 \)

EXERCISE 11

1. (A) \( \text{slope} = \frac{1}{2} y - \text{int:} -5 \) (B) \( \text{slope} = -6/5 y - \text{int:} 7/5 \)
   
   (C) \( \text{slope} = 4/3 y - \text{int:} 8 \) (D) \( \text{slope} = 5/2 y - \text{int:} -5 \)

(E) \( \text{slope} = 0 y \text{int:} y = 2 \) (F) \( \text{slope} = \text{undefined} y \text{int:} \text{None} \)

2. \( \text{F}(x) = -2x - 2 \)

Day 12

1. (A) \( y = 4x + 7 (B) y = 2x - 7 (C) y = \frac{1}{3}x - \frac{17}{3} \)
   
   (D) \( y = -\frac{10}{9}x - \frac{13}{9} (E) y = -\frac{3}{4}x + \frac{1}{2} (F) y = -\frac{3}{2}x + 3 \)

   (G) \( y = 5x - 11 (H) y = -2x + 4 (I) x = 2 \)

2. (A) \( y = 2x + 4 (B) y = -3x + 7 (C) y = -2x + 5 \)
   
   (D) \( y = -3x + 3 (E) y = \frac{1}{2}x + \frac{3}{2} (F) y = -\frac{3}{4}x + \frac{9}{4} \)

EXERCISE 12

1. (A) \( \text{slope} = \frac{5}{7} y - \text{int:} -\frac{12}{7} \) (B) \( \text{slope} = -\frac{4}{3} y - \text{int:} 2 \)

2. (A) \( y = -4x + 5 (B) y = -\frac{2}{4}x + \frac{3}{4} (C) x = -2 \)
   
   (D) \( y = \frac{1}{2}x + \frac{3}{4} (E) y = 2x - 3 \)
Day 13

1. (A) Function (B) Not Function
2. (A) Function (B) Not function (C) function
3. (A) Function (B) function (C) Not function (D) function
   (E) Not function (F) Not function
4. \( f(5) = 2 \)
5. \( (A) 7(B) - 11(C) 2a - 1 \)
6. \( (A) - 2(B) 13 \quad (C) - 3a + 10 \)
7. \( (A) - 6(B) 44 \quad (C) 3x^2 + 7x - 4 \)
8. \( (A) 25 \quad (B) 32 \quad (C) 8x^2 - 6x + 5 \)

EXERCISE 13

1. (A) Function (B) Not Function (C) function (D) Not function
   (E) function (F) Not function
2. \( f(3) = 2 \)
3. \( (A) 11 \quad (B) - 13 \quad (C) 4x + 7 \)
4. \( (A) 25 \quad (B) 53 \quad (C) 12x^2 - 14x + 5 \)

Day 14

1. \( (A) \left[ 2, \infty \right) \quad (B) \left( -\infty, -\frac{5}{2} \right) \quad (C) [8, \infty) \quad (D) [3, \infty) \quad (E) (-\infty, 2) \quad (F) [-4, \infty) \)
2. \( (A) (-\infty, \infty) \quad (B) (-\infty, 4) \quad (C) (-\infty, 4) \cup (4, \infty) \quad (D) (-\infty, \infty) \)
   (E) \([5, \infty) \quad (F) (-\infty, -2) \cup (-2, \infty) \quad (F) (-\infty, 4) \)
   (H) \((-\infty, -5) \cup (-5, \infty) \quad (I) [0, \infty) \)
3. \( (A) - 6 \quad (B) 4 \quad (C) 18 \quad (D) - 5x + 14 \quad (E) 7x - 10 \quad (F) - 6x^2 + 24 \)
4. \( (A) 9 \quad (B) 4 \quad (C) 10 \quad (D) 5x + 1 \quad (E) - x + 7 \quad (F) \frac{2x^3 + 3}{3x - 4} \)

EXERCISE 14

1. \( (A) \left( -\infty, \frac{13}{2} \right) \quad (B) \left( \frac{8}{5}, \infty \right) \)
2. \( (A) (-\infty, \infty) \quad (B) (-\infty, -1) \cup (-1, \infty) \quad (C) [4, \infty) \)
3. \( (A) 5 \quad (B) 1 \quad (C) - 4 \quad (D) 7x - 10 \quad (E) x + 2 \quad (F) \frac{1}{4} \)
4. \( (A) 1 \quad (B) 31 \quad (C) 2 \)

PRACTICE PROBLEMS FOR EXAM 2

1. \( 3\sqrt{2} - 4 \quad (B) 8 - 2\sqrt{15} \quad (C) \sqrt{3} \quad (D) \frac{3\sqrt{7 - \sqrt{5}}}{2} \)
   (E) \(14x \quad (F) 5x\sqrt{y} \)
2. \( (A) (-1, 3) \quad (B) (1, -1); 4\sqrt{3} \)
3. \( (A) 9\sqrt{3} \quad (B) \sqrt{w} \quad (C) \sqrt{x^2} \quad (D) \sqrt{y^3} \)

Day 15

1. \( (A) (8, 2) \quad (B) (-1, 2) \quad (C) (-2, -3) \quad (D) (8, -1) \quad (E) (1, 4) \quad (F) (3, 2) \quad (G) (0, 0.1) \quad (H) (1, 4) \quad (I) (1, 2) \quad (J) (-4, 3) \quad (K) (-1, 1) \quad (L) (4, 2) \quad (M) (2, 1) \quad (N) (-2, 5) \)
2. \( (A) \emptyset \quad (B) ((x, y): 10x - 4y = 2) \)

EXERCISE 15

1. \( (A) (2, 1) \quad (B) (4, 3) \quad (C) (2, 3) \quad (D) (3, -5) \quad (E) (3, -2) \quad (F) (2, 3) \quad (G) \emptyset \quad (H) ((x, y): 6x - 4y = 8) \)

Day 16

1. \( 6000 \) miles
2. \( V = 875 - 175x \)
3. \( 8, 4 \)
4. \( $39 \)
5. Senior = $6, child = $14
6. 321
7. $25,000
8. Plane speed = 135 mi/hr, wind speed = 23 mi/hr
9. 5 gallons each

EXERCISE 16

1. \( $50.25 \)
2. \( 2400 \) miles
3. Chip = $2.75, soda = $2
4. \( $37,000 \)
Day 17

1. (A) (a) \( (0, 2); \) \( x = 0; \ (0, 2); \ (\sqrt[3]{2}, 0); \ (-\sqrt[3]{2}, 0) \)
   (b) \((-\infty, \infty); \ (-\infty, 2) \) (c) Max 2
   (B) (a) \((-3, -3); \) \( x = -3; \ (0, -21): \) No \( x \) int
   (b) \((-\infty, \infty); \ (-\infty, -3) \) (c) Max -3
(C) (a) \( (4, 5); \) \( x = 4; \ (0, 53): \) No \( x \) int
   (b) \((-\infty, \infty); \ (5, \infty) \) Min 5
(D) (a) \((-1, -4); \) \( x = -1; \ (0, -3); \ (-3, 0), (1, 0) \)
   (b) \((-\infty, \infty); \ [-4, \infty) \) Min -4
(E) (a)(1,3); \( x = 1; \ (0, -1); \ (-2+\sqrt{3} \over 2, 0), (-2-\sqrt{3} \over 2, 0) \)
   (b) \((-\infty, \infty); \ (-\infty, 3) \) (c) Max 3
(F) (a)(-2, -5); \( x = -2; \ (0, 3); \ (-4+\sqrt{10} \over 2, 0), (-4-\sqrt{10} \over 2, 0) \)
   (b) \((-\infty, \infty); \ [-5, \infty) \) Min -5
(G) (a)(5, -22); \( x = 5; \ (0, 3); \ (5 + \sqrt{22}, 0), (5 - \sqrt{22}, 0) \)
   (b) \((-\infty, \infty); \ [-22, \infty) \) (c) Min -22
(H) (a)(3,23); \( x = 3; \ (0, 5); \ (6+\sqrt{36}, 0), (6-\sqrt{36}, 0) \)
   (b) \((-\infty, \infty); \ (-\infty, 23) \) (c) Max 23

2. (A) Max 8  (B) MIN -5  (C) Max 21  (D) MIN -1

3. (A) \( y = 2(x - 3)^2 - 2 \)  (B) \( y = 1 \over 2(x - 4)^2 - 3 \)
4. \( y = 2(x - 1)^2 - 3 \)

EXERCISE 17

1. (A) (a) \((-3, 4); \) \( x = -3; \ (0,22): \) No \( x \) int
   (b) \((-\infty, \infty); \ [4, \infty) \) (c) Min 4
   (B) (a)(5,2); \( x = 5; \ (0, -73); \ (15 + \sqrt{36}, 0) \)
   (b) \((-\infty, \infty); \ [-2, \infty) \) (c) Max 2
   (C) (a) \( \left(\frac{5}{2}, -\frac{7}{2}\right) \) : \( x = \frac{5}{2}; \ (0, 0); \ (5 + \sqrt{7}, 0) \)
   (b) \((-\infty, \infty); \ [2, \infty) \) (c) Min \( -\frac{7}{2} \)
   (D) (a) \( \left(\frac{35}{4}, \frac{7}{4}\right) \) : \( x = \frac{35}{4}; \ (0, 0); \ (\frac{9 + \sqrt{105}}{6}, 0) \)
   (b) \((-\infty, \infty); \ [-\frac{35}{4}, \ infty) \) (c) Max \( \frac{35}{4} \)

2. \( y = \frac{5}{9}(x - 2)^2 - 3 \)

Day 18

1. 50 ft by 50 ft
2. 1800 square ft
3. (A) 1 sec, 3 sec  (B)4 second  (C) NO
4. (A) 2 second  (B) 576 ft  (C) 8 second
5. $360,000
6. Length 14 ft and width 11 ft

EXERCISE 18

1. (A) 8 sec  (B) 2 sec  (C) 180 ft
2. 125 ft by 125 ft
3. 10ft-20ft-10ft, 200 square ft.

Day 19

1. (A) \( \frac{-6x}{7} \)  (B) \( \frac{4p}{7} \)  (C) \( \frac{1}{3x} \)  (D) \( \frac{5x-1}{8} \)  (E) \( \frac{1}{x+5} \)  (F) \( \frac{1}{x-2} \)
   (G) \( \frac{x^2+2}{x-3} \)  (H) \( x^4 + x^7 \)  (I) \( \frac{62}{21} \)  (J) \( \frac{134x}{135x} \)  (K) \( \frac{2+4}{x+2} \)  (L) \( \frac{3}{x+5} \)
   (M) \( \frac{x}{x+3} \)  (N) \( \frac{(x-1)(x-5)}{(x-2)} \)
2. (A) \( \frac{50}{13x} \)  (B) \( \frac{12}{18} \)  (C) \( \frac{8}{D} \)  (D) \( \frac{x-1}{2} \)  (E) \( \frac{x-2}{x+3} \)  (F) \( \frac{x-1}{x+2} \)
3. (A) \( \frac{5x+5}{x+3} \)  (B) \( \frac{8-x}{10} \)  (C) \( \frac{5x-6}{5x^2+30x} \)  (D) \( \frac{2}{3x+4} \)  (E) \( \frac{2+4}{3x} \)  (F) \( \frac{8-10}{2x} \)
4. (A) \( \frac{6x+43}{x^2-49} \)  (B) \( \frac{4x-23}{x^2+10x+25} \)  (C) \( \frac{2x-2}{x-3} \)  (D) \( \frac{3x^2+5x+2}{x+2}(x+2) \)

EXERCISE 19

1. (A) \( \frac{1}{x-1} \)  (B) \( \frac{3x}{2x+1} \)  (C) \( \frac{5(2x+5)}{2x} \)  (D) \( \frac{x-1}{x+5} \)  (E) \( \frac{3x}{6} \)  (F) \( \frac{x+1}{x-4} \)
2. (A) \( \frac{2x+4}{x(x+1)} \)  (B) \( \frac{2x}{x^2+4} \)  (C) \( \frac{6x+43}{x^2-49} \)  (D) \( \frac{x-38}{x+7}(x-6) \)  (E) \( \frac{7x-26}{(x+2)(3x+4)} \)

Day 20

1. (A) \( \{1\} \)  (B) \( \{3, -1\}(C) \left\{-\frac{1}{3}, 2\right\} \)  (D) \( \left\{\frac{2}{3}\right\} \)  (E) \( \{3, -2\} \)  (F) \( \left\{\frac{1}{3}\right\} \)
   (G) \( \{0\} \)  (H) \( \left\{-\frac{3}{2}\right\} \)  (I) \( \{3, 6\} \)  (J) \( \left\{-\frac{2}{3}\right\} \)
2. \( \frac{30}{11} \) hrs
3. \( \frac{70}{17} \) hrs
4. \( \frac{45}{14} \) hrs
5. \( \frac{3}{2} \) mile hr
6. \( \frac{10}{8} \) hrs
7. Andrew 6 hrs; Bailey :12 hrs

EXERCISE 20

1. (A)\( \{3, -5\} \)  (B)\( \{-1, -11\}(C) \left\{-\frac{9}{5}, 5\right\} \)  (D) \( \left\{-\frac{2}{5}\right\} \)  (E) \( \left\{-\frac{5}{3}\right\} \)
2. \( \frac{42}{13} \) hrs
PRACTICE PROBLEMS FOR EXAM 3

1. (A) (−2,1) (B)(−3,2) (C)(3,11) (D)(3,−5) (E)x[6x−9y = 18] (F) No solution
2. The price of cutter is $2.50 and the price of glue is $1.50
3. 83
4. $15,000

5. (A) (a)(−4,5); x = −4; (0,−27); \( \left(\frac{a+\sqrt{10}}{2}, 0\right), \left(\frac{a-\sqrt{10}}{2}, 0\right) \)
   (b)(−∞, ∞); (−∞, 5] (c)Max 5
   (B) (a)(3,−2); x = 3; \( \left(\frac{5}{2}, 0\right), (5, 0), (1,0) \)
   (b)(−∞, ∞); (−2, 0) (c)Min = 2
   (C) (a)(−2,10); x = −2; (0,6); \( (2 + \sqrt{10}, 0), (2 − \sqrt{10}, 0) \)
   (b)(−∞, ∞); (−∞, 10] (c)Max 10
   (D) (a)(2,−7); x = 2; (0,1); \( \left(\frac{a+\sqrt{10}}{2}, 0\right), \left(\frac{a-\sqrt{10}}{2}, 0\right) \)
   (b)(−∞, ∞); (−7, 0) (c)Min = 7
   (E) (a)\( \left(\frac{1}{2}, -\frac{3}{2}\right) ; x = \frac{3}{2} ; (0,3) ; \left(\frac{3+\sqrt{3}}{2}, 0\right), \left(\frac{3-\sqrt{3}}{2}, 0\right) \)
   (b)(−∞, ∞); \( \left[-\frac{3}{2}, -\frac{3}{2}\right] \) (c)Min = \( -\frac{3}{2} \)
   (F) (a)(−1,1); x = −1; (0,−5); No x − int
   (b)(−∞, ∞); (−∞, 1] (c)Max = 1
6. (A)y = 7(x−2)^2 − 3 (B)y = −\( \frac{1}{2} \)(x + 4)^2 + 5
7. (A) 6 sec (B) 576 ft (C) 3 sec and 9 sec (D) 12 sec
8. (A) $550 (B) $907,500
9. 160 yd by 160 yd
10. 92,450 square yards
11. 9 cm
12. (A) \( \frac{x−13}{x(x+3)(x−3)} \) (B) \( \frac{5x+1}{x(x−3)(x+5)} \) (C) \( \frac{23x−22}{(x+2)(7x−3)} \)
    (D) \( \frac{10x+1}{x(x−3)(x+3)x} \) (E) \( \frac{(x+5)(x−2)}{(x+5)x} \) (F) \( x+1 \)
    (G) \( \frac{x^3+3}{x^3} \) (H) \( \frac{y^3+1}{y} \)
13. (A)\( \left[\frac{3}{2}, \frac{7}{2}\right] \) (B) \( \left[\frac{1}{2}, \frac{5}{2}\right] \)
14. \( \frac{176}{27} \) hrs

EXERCISE 21

1. (A)1 (B) − 41 (C)10x − 19 (D)10x − 11
2. (A)Not (B) one to one (C)Not (C) one to one
3. \( (A)f^{-1}(x) = \frac{x+6}{3} \quad (B)f^{-1}(x) = x^3 + 1 \)

Day 22

1. (A)x = 5 (B)64 = b^3 (C)b = 5 (D)x − 3 = 3^r
2. (A)2 = log_12(x) (B)12 = ln(h) (C)5 = log_a(b)
   (D)4 = log_5+4(b)
3. (A) 4 (B) 1.2091 (C) 3.3219 (D) 0.9208
4. (A) (−∞, ∞); (2,∞); y = 2; 3
   (B)(−∞, ∞); (−3,∞); y = −3; −2
   (C)(0,∞); (−∞, ∞); x = 0; 1
   (D)(0,∞); (−∞, ∞); x = 0; 1
5. (A)2 (B)7 (C) \( \frac{22}{10} \) (D) − \( \frac{7}{4} \) (E)1 (F) \( \frac{13}{9} \) (G) − 1 (H) − 5
   (I)2 (J)2.3 (K) − 8 (L)3,−1

EXERCISE 22

1. (A)a^x = b (B)b^y = x + 5
2. (A)2 = log_1(x+1) y (B)x + 3 = log_a y
3. (A) \( \frac{2}{5} \) (B) − \( \frac{4}{3} \) (C) − 8 (D) \( \frac{5}{2} \)

Day 23

1. (A)6log_a(u) + 5log_a(v) (B)2log_b(x) + \( \frac{1}{2} \)log_b(y)
   (C) ln(x) − ln(w) − 4ln(y)
   (D)3 log(x) − \( \frac{1}{2} \)log(y) − 2log(w)
2. (A) log_10(xy) (B) ln \( \frac{x^2}{y^2} \) (C) log \( \frac{x^2}{17} \) (D) log(x^4 y^6)
   (E) ln \( \frac{x^2}{y^2} \) (F) log \( \frac{x^2}{y^2} \)
3. (A) 4 (B)1.2091 (C)3.3219 (D) 0.9208
4. (A)7 (B) no solution (C)3 (D) \( \frac{11}{2} \) (E)3 (F) 7 (G) \( \frac{2}{3} \) (H)2
   (I)97 (J)9 (K)25 (L)4
EXERCISE 23

1. \((A) 3 \log_a x + 4 \log_a y \quad (B) 5 \log_b x - 7 \log_b y\)

2. \((A) \log_{10}(x^5 y^9) \quad (B) \ln \left(\frac{27}{37}\right)\)

3. \((A) \frac{9}{2} \quad (B) 3, -1 \quad (C) 6 \quad (D) \frac{101}{2}\)

PRACTICE PROBLEMS FOR EXAM 4

1. \((A) 4 = \log_2(16) \quad (B) 2 = \log_3(9) \quad (C) a = \log_b(b) \quad (D) a = \log_{x-2}(y)\)

2. \((A) 2^2 = 8 \quad (B) 5^2 = 25 \quad (C) 2^n = x \quad (D) 10^x = z\)

3. \((A) 2.3219 \quad (B) 1.3383\)

4. \((A) f^{-1}(x) = \frac{x+6}{3} = \frac{1}{3}x + 2 \quad (B) f^{-1}(x) = \frac{4-x}{2} = 2 - \frac{x}{2} \quad (C) f^{-1}(x) = \sqrt{x + 8} \quad (D) f^{-1}(x) = \sqrt{x} - 2 \quad (E) f^{-1}(x) = x^3 - 4 \quad (F) f^{-1}(x) = x^3 + 5\)

5. \((A) Yes \quad (B) No \quad (C) Yes \quad (D) No \quad (E) Yes \quad (F) No\)

6. \((A) x = \frac{5}{2} \quad (B) x = 4 \quad (C) x = \frac{12}{7} \quad (D) x = \frac{3}{2} \quad (E) x = 9 \quad (F) x = \frac{3}{2} \quad (G) x = 103 \quad (H) x = \frac{1}{6}\)

7. \((A) 0.9344 \quad (B) 0.1077 \quad (C) 0.1192 \quad (D) -0.0346\)

8. \((A) 73,788 \quad (B) 156,209\)