1. To **Simplify** an exponential expression means to write an expression which is equal to the original, in which each variable appears at most once, and which has no negative exponents.

Simplify the exponential expression: \((3x^2)^{1/2}(3x^{-2})^{-1/2}\)
2. Solve the equation

\[ \frac{x}{x + 1} + 1 = \frac{1}{x - 1} \]
3. Solve the equation

\[ 1 + \sqrt{x + 5} = x \]

and check your answer(s) on paper.
4. Solve the inequality

\[ |2x - 3| < 5 \]
5. Sterling silver is an alloy which is 92.5% silver (by weight). How much of an alloy which is 90% silver, and how much pure silver, must I combine to make 100 grams of sterling silver?
6. Find the point of intersection of the lines given by

\[0.3x + 0.2y = 0.15\]

and

\[0.4x + 0.3y = 0.55\]
7. Let $A = (2, 5)$ and $B = (7, 3)$.

(a) Find the distance between $A$ and $B$.

(b) Find the midpoint between $A$ and $B$.

(c) Find the equation of the line containing $A$ and $B$.

(d) Find the point $Q$ on the $y$-axis which is equidistant from $A$ and $B$. 
8. Let \( f(x) = 2x^2 + 5 \)

(a) Find \( f(a) \).

(b) Find \( f(a + h) \).

(c) Find and simplify \( \frac{f(a + h) - f(a)}{h} \) if \( h \neq 0 \).
9. Let \( f(x) = \frac{x + 2}{x} \).

(a) Show that \( f(x) \) is one to one.

(b) Find the inverse function, \( f^{-1}(x) \).
10. Express \( \log_b \left( \frac{xy^2}{zw^3} \right) \) in terms of \( \log_b(x) \), \( \log_b(y) \), \( \log_b(z) \) and \( \log_b(w) \).
11. Solve the equation

\[ \log(x + 3) + \log(x + 6) = 1 \]
12. Solve the equation

\[ 5^x = 2^{x+3} \]

Find \( x \) exactly and to two decimal places.
13. If an initial dose $q_0$ milligrams is given, then the amount, $A$, of the asthma drug theophylline in the bloodstream of a patient is given by

$$A = q_0 \times e^{-0.2t}$$

If a 500 milligram dose is given, how long will it take until the amount in the bloodstream is 200 milligrams? (Find your answer to the nearest 0.1 hour. To receive full credit, you must solve the equation by algebraic methods, not trial and error.)
14. If \( \sin(t) = \frac{2}{3} \), and \( \cos(t) < 0 \), find the exact values of the trigonometric functions. (Exact means “find them as fractions, rather than as decimal expansions.”)

\[
\begin{align*}
\sin(t) &= \frac{2}{3} \\
\cot(t) &= \\
\cos(t) &= \\
\sec(t) &= \\
\tan(t) &= \\
\csc(t) &= 
\end{align*}
\]
15. A ladder 30 feet long is leaning against the side of a building. If the base of the ladder makes an angle of $65^\circ$ with the ground, find the height of the top of the ladder above the ground (to the nearest 0.1 ft.).
16. Use the fundamental identities to transform
\[
\frac{1 - \cos(\theta)}{\sec(\theta) - 1}
\]
into \(\cos(\theta)\).
17. If \( \sin(A) = \frac{1}{\sqrt{10}} \), \( \cos(A) = \frac{3}{\sqrt{16}} \), \( \sin(B) = \frac{2}{\sqrt{5}} \), and \( \cos(B) = \frac{1}{\sqrt{5}} \), find the exact values of \( \sin(A + B) \) and \( \cos(A + B) \).
18. Solve the equation \( \cos(2x) = 0 \): find all values of \( x \), in radians, which satisfy this equation.
19. (a) (5 points extra credit) Let \( A = (0,0), B = (10,15), C = (0,10), \) and \( D = (10,0). \) Find the point where the line segment \( \overline{AB} \) intersects the line segment \( \overline{CD}. \)

(b) (5 points extra credit) For what value (or values) of \( K \) does the quadratic equation \( 3x^2 + Kx + 1 = 0 \) have exactly one real solution? Explain.
20. (a) (5 points extra credit) A frog jumps off the edge of a 3 foot high table, and attains a maximum height of 4 feet at a point which is 2 feet to the right of the table. The path of the frog through space forms a parabolic arc. Find the quadratic function which gives the parabola. (Use the floor as the x-axis, and put the y-axis along the edge of the table.) Then find the distance between the table and the point on the floor where the frog lands.

(b) (5 points extra credit) If $\triangle ABC$ has side $b = 5$, side $c = 8$ and $\angle A = 60^\circ$, find the length of side $a$. 