Instructions. Part I: Do each of the following 8 problems. Each problem is worth 5pts. Show all appropriate details in your solutions. Calculators are not allowed. Good Luck! When you turn this in, please pick up Part II which has 4 problems.

1. Solve the linear equation $\frac{1}{2}x + 7 - \frac{1}{4}x = \frac{19}{2}$.

   \[ \Rightarrow 4\left(\frac{1}{4}x + 7\right) = \left(\frac{19}{2}\right) \Rightarrow x + 28 = 19 \Rightarrow x = 10 \]

   Check: $\frac{1}{2}(10) + 7 - \frac{1}{4}(10) = 5 + 7 - 2.5 = 9.5 = \frac{19}{2}$

2. Solve the formula $A = P + Prt$ for $P$.

   \[ A = P(1 + rt) \Rightarrow P = \frac{A}{1 + rt} \]

3. Solve the equation $\frac{1}{2}x^2 + \frac{3}{4}x = 1$.

   \[ \Rightarrow \frac{1}{2}x^2 + \frac{3}{4}x - 1 = 0 \Rightarrow 2x^2 + 3x - 4 = 0 \]

   \[ \Rightarrow x = \frac{-3 \pm \sqrt{9 - 4(2)(-4)}}{4} = \frac{-3 \pm \sqrt{41}}{4} \]

4. Solve the equation $\frac{4}{x - 1} + \frac{7}{x + 7} = \frac{5}{x - 1}$.

   \[ x \neq 1, x \neq -7 \]

   \[ \Rightarrow (x - 1)(x + 7) \left[ \frac{4}{x - 1} + \frac{7}{x + 7} \right] = \left(\frac{5}{x - 1}\right)(x - 1)(x + 7) \]

   \[ \Rightarrow 4(x + 7) + 7(x - 1) = 5(x + 7) \Rightarrow 7(x - 1) = x + 7 \]

   \[ \Rightarrow 7x - 7 = x + 7 \Rightarrow 6x = 14 \Rightarrow x = \frac{14}{6} = \frac{7}{3} \]

   \[ \therefore x = \frac{7}{3} \]
5. Solve the radical equation $\sqrt{2x-5} - \sqrt{x+1} = 1$. Check all proposed solutions.

\[ (\sqrt{2x-5})^2 = (\sqrt{x+1})^2 \]
\[ 2x - 5 = 1 + 2\sqrt{x+1} + x + 1 \]
\[ (x-7)^2 = (2\sqrt{x+1})^2 \]
\[ x^2 - 14x + 49 = 4(x+1) \]
\[ x^2 - 18x + 45 = 0 \]
\[ (x-3)(x-15) = 0 \]
\[ x = 3 \quad \text{or} \quad x = 15 \]

Check: $x = 3$
\[ \sqrt{1} - \sqrt{4} = 1 \]
\[ x = 15 \]
\[ \sqrt{25} - \sqrt{16} = 1 \]
\[ 5 - 4 = 1 \]

\[ x = 15 \text{ is solution} \]

6. Solve the inequality $x^2 + 7x > -10$. Write your answer in interval notation.

\[ \Rightarrow x^2 + 7x + 10 > 0 \quad \Rightarrow (x + 5)(x + 2) > 0 \]

Critical Points: $x = -5$, $x = -2$

\[ \begin{array}{c|c|c}
\text{Test} & x + 5 & x + 2 \\
\hline
\text{Check} & -5 & -2 \\
\hline
\text{pos} & 0 & \text{neg} & 0 & \text{pos}
\end{array} \]

Solution: $(-\infty, -5) \cup (-2, \infty)$

7. Solve the inequality $|3 - 2x| \geq 5$. Write your answer in interval notation.

\[ \Rightarrow 3 - 2x \leq -5 \quad \text{or} \quad 3 - 2x \geq 5 \]
\[ \Rightarrow -2x \leq -8 \quad \text{or} \quad -2x \geq 2 \]
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\[ \Rightarrow -2x \leq -8 \quad \text{or} \quad -2x \geq 2 \]
\[ \Rightarrow x \geq 4 \quad \text{or} \quad x \leq -1 \]

Solution: $(-\infty, -1] \cup [4, \infty)$

8. Given that $y$ varies inversely as the square of $x$, and $y = 3$ when $x = 2$, write an equation that expresses the relationship between $y$ and $x$.

\[ y = \frac{k}{x^2} \]

Now, \[ 3 = \frac{k}{2^2} \]
\[ \Rightarrow k = 12 \]
Instructions. Part II: Do each of the following 4 problems. Each problem is worth 5pts. Show all appropriate details in your solutions, you may use a calculator to compute numbers.

9. The cost to install a new carpet in an office is determined by a $550 fixed fee plus a fee of $45 per square yard of floor space to be covered. How many square yards of floor space can be carpeted at a cost of $3800? Round answer to the nearest square yard.

\[
\begin{align*}
550 + 45x &= 3800 \\
45x &= 3250 \\
x &= \frac{3250}{45} \approx 72.2 \text{ yards}
\end{align*}
\]

10. An investment of $2500 is made at an annual simple interest rate of 5.5%. How much additional money must be invested at an annual simple interest rate of 8% so that the total interest earned is 7% of the total investment?

\[
\begin{align*}
(2500)(0.055) + x(0.08) &= (2500 + x)(0.07) \\
137.5 + 0.08x &= 175 + 0.07x \\
0.01x &= 37.50 \\
x &= 3750\text{ additional money should be invested.}
\end{align*}
\]

11. The height of a model rocket in feet is given by \(h(t) = -16t^2 + 220t\), where \(t\) is the number of seconds after the launch. How many seconds after the launch will the rocket be 350 feet above the ground? Round to the nearest tenth of a second.

\[
\begin{align*}
-16t^2 + 220t &= 350 \\
-16t^2 + 220t - 350 &= 0 \\
16t^2 - 220t + 350 &= 0 \\
(t - 220 \pm \sqrt{220^2 - 4(16)(350)})/32 \\
&= 18.36 \text{ or } 11.91 \text{ seconds above ground.}
\end{align*}
\]

12. The maximum load that a cylindrical column of circular cross section can support varies directly as the fourth power of diameter and inversely as the square of its height. If a column 3 feet in diameter and 12 feet high supports up to 16 tons, how much can a column 6 feet in diameter and 20 feet high support? Round your answer to the nearest tenth of a ton.

\[
L = \frac{k d^4}{h^2} \Rightarrow 16 = \frac{k(3)^4}{12^2} \Rightarrow k = 28.8
\]

\[
d = 6 \Rightarrow h = 20 \Rightarrow \frac{L d(28.8)(6)'}{20^2} = 92.15 \Rightarrow \text{Such a column can support up to 92.2 tons}
\]