Problem 1. Solve the following systems of equations for $x_1$ and $x_2$ using the method of substitution.

a. 
\[
\begin{align*}
\{ & x_1 = 125, \ x_2 = 32 \\
& 100x_1^{-2/3}x_2^{3/5} - 32 = 0 \\
& 180x_1^{1/3}x_2^{-2/5} - 225 = 0
\end{align*}
\]
b. 

\[
\{ x_1 = 729, \ x_2 = 81 \}
\]

\[
162x_1^{-5/6}x_2^{1/4} - 2 = 0
\]

\[
243x_1^{1/6}x_2^{-3/4} - 27 = 0
\]
Problem 2. Solve the following systems of equations for $x_1$ and $x_2$ first using the method of substitution and then using the method of elimination.

a. 

\[
\begin{align*}
&x_1 = -1, \quad x_2 = 2 \\
&2x_1 + 2x_2 = 2 \\
&3x_1 + 4x_2 = 5
\end{align*}
\]
b. 

\[ \{ x_1 = 1, x_2 = 3 \} \]

\[ 7x_1 + 5x_2 = 22 \]

\[ 3x_1 + 2x_2 = 9 \]
**Problem 3.** Solve the following system of equations for $x_1$, $x_2$, and $x_3$ first using the method of substitution and then using the method of elimination.

$$\begin{align*}
    x_1 &= 3, \\ x_2 &= 1, \\ x_3 &= -2
\end{align*}$$

\[x_1 + x_2 + x_3 = 2\]
\[5x_1 + 6x_2 + 4x_3 = 13\]
\[3x_1 - 2x_2 + 7x_3 = -7\]
Elimination here
Problem 4. Find the derivatives of each of the following functions with respect to x.

a. \( y = 4x^2 - 3x^3 \)

b. \( f(x) = 4e^x + \frac{1}{2}x^2 \)

c. \( f(x) = 5x^3 - 2\log[x] \)

d. \( f(x) = 2x^5 - 5x^4 + 4^x \)

e. \( f(x) = 15x^{1/2} + 9x^{2/3} - 18x^{1/6} \)

f. \( f(x) = 5x^3 - 2xe^x \)
g. \( f(x) = 3x^5 \log[x] \)

h. \( f(x) = (4x - 2)^2 \)  
   Find in two different ways.

i. \( f(x) = \frac{5x^3}{2x^3 + 4x} \)

j. \( f(x) = \frac{6x^2 - x - 2}{2x^2 - 2x - 4} \)
Problem 5. Find the derivatives of each of the following functions with respect to $x$.

a. $f(x) = (2x^2 + 3)^3$

b. $f(x) = (6x - 5)(2x + 3)$  
Show two ways.

c. $f(x) = 3xe^{2x^2+3x}$

d. $f(x) = 3x^2 \log(2x^2 + 3x)$
e. $f(x) = 2x^3 \log(2x^2 + 4x)$

f. $f(x) = e^{(x^3 - 4x)^2}$

g. $f(x) = \frac{2xe^{3x}}{\log(x)}$
h. \( f(x) = \frac{3x^2 e^{2x}}{4x^{3/2} + 2} \)
Problem 6. For each of the following, take the derivative with respect to $x_1$, set the derivative equal to zero and solve the resulting equation for $x_1$.

a. \( \{x_1 = 243\} \)
   \[ f(x) = 3645x_1^{1/5} - 9x_1 \]

b. \( \{x_1 = 216\} \)
   \[ f(x) = 540x_1^{1/3} - 5x_1 \]
c. \( \{ x_1 = 256 \} \)
\[
f(x) = 768x_1^{1/4} - 3x_1
\]
Problem 7. Do the following problems from the book.

a. Section 6.2
   1) 1 (The comparison is with equation 6 in the text, not problem 6)
   2) 3
   3) 5
b. Section 6.3
   1) 1

c. Section 6.4
   1) 1
   2) 3
   3) 7
d. Section 6.5
   1) 1a
   2) 1b
   3) 1c
   4) 1d
e. Section 6.6
   1) 3a
   2) 3b
   3) 3c
   4) 3d
   5) 3e
   6) 3f
   7) 3g
   8) 3h