Problem 1: Let $A = \{1, 2, 3, 4, 5, 6, 7\}$ and $B = \{1, 4, 8\}$.

(a) List all elements of $\mathcal{P}(B)$ (the power-set of $B$).
\{\emptyset, \{1\}, \{4\}, \{8\}, \{1, 4\}, \{1, 8\}, \{4, 8\}, \{1, 4, 8\}\}

(b) List all elements of $A \cap B$.
\{1, 4\}

(c) In how many ways we can choose a three-element subset of $A$?
\(\binom{7}{3}\)

(d) In how many ways we can list all elements of $A$?
7!

(e) What is the number of functions that map $A$ into $B$?
\(3^7\)

In parts (c), (d), (e) it is sufficient to give the correct formula; you do not have to calculate the numerical value.
Problem 2: (a) Solve equation $2x^2 - x - 2 = 0$. Show your work.
Using the formulas for the roots, we get $x = \frac{1 \pm \sqrt{17}}{4}$

(b) Solve equation $x^3 + x^2 - 4x + 2 = 0$. Compute all roots and show your work.
There are four candidate roots 1, −1, 2, −2. Trying them all, we find that 1 is a root. Factoring, we get $x^3 + x^2 - 4x + 2 = (x - 1)(x^2 + 2x - 2)$, and computing the roots of $x^2 + 2x - 2 = 0$, we get that all the roots are 1, $-1 \pm \sqrt{3}$. 
Problem 3: Determine the numerical values of the expressions below:

\[ 6! = 720 \]

\[ \gcd(117, 195) = 39 \]

\[ 9 + 10 + \ldots + 38 + 39 = \frac{39 \cdot 40}{2} - \frac{8 \cdot 9}{2} = 744 \]

\[ \binom{15}{3} = 455 \]

\[ \sum_{i=0}^{\infty} \left(\frac{1}{5}\right)^i = \frac{5}{4} \]