1. (2 points) Accurately rounded off to two places after the decimal point, find the x-values of all intersection points on the graphs of $y = x^4$ and $y = 80 + 30x$.

![Graph with intersection points marked.]

*USE CALCULATOR TO OBTAIN GRAPH. THEN USE 2ND-CALC-INTERSECT

$x \approx -2.06$ and $x \approx 3.72$

2. (3 points) H. Graver Packing Co. was formed in Chicago in the early 1900's. The table below shows the number of workers employed by the company in the given year.

<table>
<thead>
<tr>
<th>year</th>
<th>1920</th>
<th>1930</th>
<th>1940</th>
<th>1950</th>
<th>1960</th>
<th>1970</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of employees</td>
<td>25</td>
<td>30</td>
<td>40</td>
<td>64</td>
<td>90</td>
<td>115</td>
</tr>
</tbody>
</table>

(a) What is the average rate of change in the number of employees between 1960 and 1970? Round off your answer to one place after the decimal point and be sure to include proper units.

$$\frac{\Delta \text{#Emp.}}{\Delta \text{year}} = \frac{115 - 90}{1970 - 1960} = \frac{25}{10} = 2.5 \text{ employees/year}$$

(b) If the number of employees continues to increase at the same rate as it did between 1960 and 1970, then in precisely what year will the company have 200 employees?

Let $N = \# \text{employees}$ after 1970

Then $N = 2.5t + 115$

200 = 2.5t + 115

$85 = 2.5t$

$t = \frac{85}{2.5} = 34 \text{ years}$

$1970 + 34 = 2004$
3. (5 points) The figure below shows the amount of caffeine, \( C = f(t) \), in mg, in a person's bloodstream as a function of the time, \( t \), in hours, since the person finished a cup of coffee.

(a) Estimate \( f(8) \) and interpret it using a complete English sentence. This sentence should be easily understood by someone who knows very little mathematics.

\[ f(8) = 30 \text{ mg} \]

8 hours after finishing a cup of coffee, this person has 30 mg of caffeine in the bloodstream.

(b) Find the average rate of change in the caffeine levels between \( t = 0 \) and \( t = 8 \). Interpret your answer using a complete English sentence.

\[
\frac{\Delta C}{\Delta t} = \frac{f(8) - f(0)}{8 - 0} = \frac{30 - 120}{8} = -11.25 \text{ mg/hr}
\]

During the 8 hours after finishing a cup of coffee, the caffeine left the bloodstream at an average of 11.25 mg per hour.
(c) About how many hours have passed before the caffeine level is down to 75 mg?

\[2.6 \text{ hours}\]

(d) For the graph shown, what is the value of the vertical intercept. Interpret your answer using a complete English sentence.

\[f(0) = 120 \text{ mg}\]

At the moment he completed his cup of coffee, this person had 120 mg of caffeine in his bloodstream.

(e) If this graph had a horizontal intercept, what would it represent in terms of caffeine or time?

It would represent the length of time needed for the caffeine from one cup of coffee to leave the bloodstream.