Final answers should have accuracy to 6 decimal places (or 4 decimal places for table-derived answers). Show some work how the mean and standard deviation are computed. *Giving only the answer will bring you few points.*

1. (15pts) A meteorologist tracks the weekly amount of rainfall in a certain location. The rounded results are below.
a) Find the range of the data.
b) Find the mean of the data.
c) Find the standard deviation of the data.

Rainfall (millimeters)	Frequency (weeks)
10	7
20	12
30	16
40	13
50	4

a) $range = 50 - 10 = 40$

b) $\bar{x} = \dfrac{7\cdot10 + 12\cdot20 + 16\cdot30 + 13\cdot40 + 4\cdot50}{7+12+16+13+4}$

$= \dfrac{1510}{52} = 29.038462$ mm

c) $7(10-\bar{x})^2 + 12(20-\bar{x})^2 + \cdots + 13(40-\bar{x})^2 + 4(50-\bar{x})^2$

$= 6851.92\ldots$

$s = \sqrt{\dfrac{6851.92\ldots}{51}} = 11.591007$

2. (15pts) The weights of inhabitants of a certain country have been found to have mean 172 lbs, with standard deviation of 6 lbs. Use the 68-95-99.7 rule (draw a picture) to find the percentage of inhabitans whose weight is:
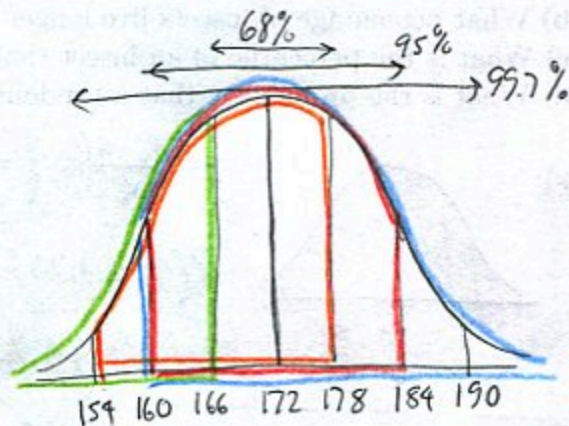
a) between 160 and 184 lbs
   95%

b) under 166 lbs
   $50 - \dfrac{68}{2} = 16\%$

c) over 160 lbs
   $50 + \dfrac{95}{2} = 97.5\%$

d) between 154 and 178 lbs.
   $\dfrac{99.7}{2} + \dfrac{68}{2} = 83.85\%$

3. (5pts) A survey of 927 adults found that 62% of them agree with continued US support for Ukraine. Find the margin of error of this survey and explain what it means.

$$\frac{1}{\sqrt{927}} \cdot 100\% = 3.284431$$

$$62 + 3.28\ldots = 65.284431$$
$$62 - 3.28\ldots = 58.715569$$

With 95% probability the true percentage of adults agreeing with support for Ukraine is between 58.71% and 65.28%.

4. (5pts) On product satisfaction surveys where a higher score means a better product, product A scored 30 on a survey with with mean 31 and standard deviation 1.5, and product B scored 45 on a survey with mean 47 and standard deviation 2.5. Use z-scores to determine which product is worse.
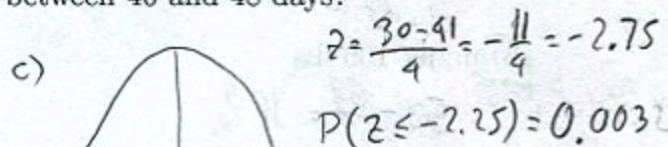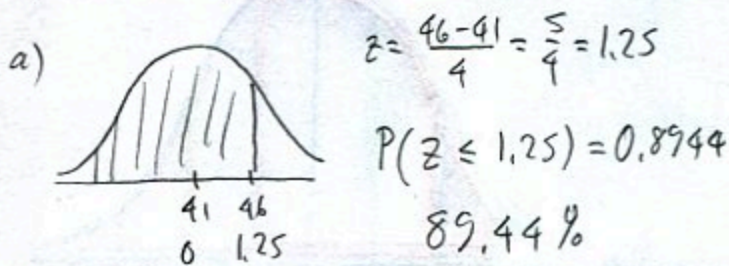
A: $\frac{30-31}{1.5} = -\frac{1}{1.5} = 0.666667$

B: $\frac{45-47}{2.5} = -\frac{2}{2.5} = -0.8$

B is worse, as it is 0.8 standard deviations below the mean.

5. (20pts) The lifespan of a certain insect is normally distributed with mean 41 days and standard deviation 4 days. Draw a picture showing which area you are computing as you answer:

a) What percentage of insects live up to 46 days?
b) What percentage of insects live longer than 50 days?
c) What is the percentile of an insect that lived 30 days? What does this mean?
d) What is the probability that a random insect lives between 40 and 48 days?

a)

$$z = \frac{46-41}{4} = \frac{5}{4} = 1.25$$

$$P(z \le 1.25) = 0.8944$$

$$89.44\%$$

b)

$$z = \frac{50-41}{4} = \frac{9}{4} = 2.25$$

$$P(z \ge 2.25)$$
$$= 1 - P(z \le 2.25)$$
$$= 1 - 0.9878$$

1.22% $= 0.0122$

c)

$$z = \frac{30-41}{4} = -\frac{11}{4} = -2.75$$

$$P(z \le -2.25) = 0.0032$$

0.3rd percentile

Means: 0.3% of insects lived shorter than this insect.

d)

$$z = \frac{48-41}{4} = 1.75, \quad z = \frac{40-41}{4} = -0.25$$

$$P(-0.25 \le z \le 1.75) = A_1 - A_2$$
$$= 0.9599 - 0.4013$$
$$= 0.5586$$