

Final answers should have accuracy to 6 decimal places. Show some work how the mean and standard deviation are computed. *Giving only the answer will bring you few points.*

1. (18pts) Every morning at sunrise, an ornithologist (a biologist with a focus on birds) counts the number of herons at a pond, with the data below.

- a) Find the range of the data.
 b) Find the mean of the data.
 c) Find the standard deviation of the data.

Number of birds	Frequency (days)
0	12
1	3
2	4
3	21
4	14
5	5
6	8
8	2
69	

a) $8 - 0 = 8$

b) $\bar{x} = \frac{12 \cdot 0 + 3 \cdot 1 + 4 \cdot 2 + 21 \cdot 3 + 14 \cdot 4 + 5 \cdot 5 + 8 \cdot 6 + 2 \cdot 8}{69}$

$= \frac{219}{69} = 3.173913$

c) $12 \cdot (0 - 3.173913)^2 + 3 \cdot (1 - 3.173913)^2 + 4 \cdot (2 - 3.173913)^2 + 21 \cdot (3 - 3.173913)^2 + 14 \cdot (4 - 3.173913)^2 + 5 \cdot (5 - 3.173913)^2 + 8 \cdot (6 - 3.173913)^2 + 2 \cdot (8 - 3.173913)^2 = 277.913043$

$\sqrt{\frac{277.913043}{69-1}} = \sqrt{4.086957} = 2.021622$

2. (20pts) Compute the following areas under a standard normal distribution curve. Draw a picture showing which area you are computing.

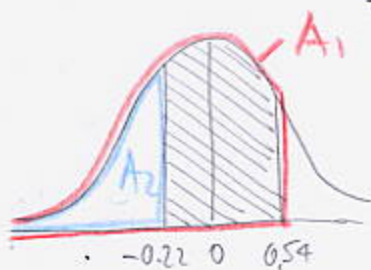
a) $A(Z \leq 0.44) = 0.6700$



b) $A(-0.12 < Z) = 1 - A_1 = 1 - 0.4522 = 0.5478$



c) $A(-0.22 < Z < 0.54) = A_1 - A_2 = 0.7054 - 0.4129 = 0.2925$



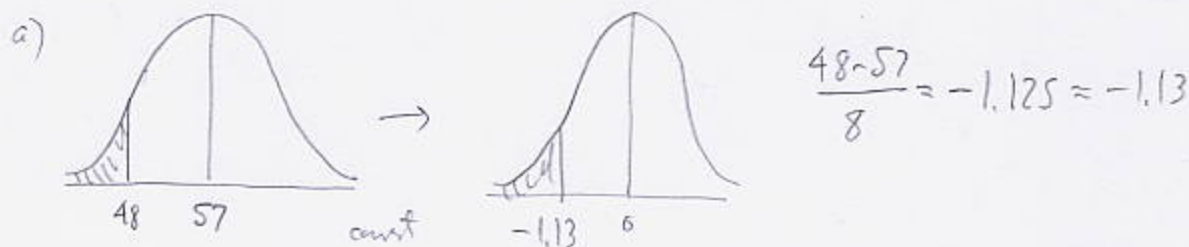
d) $A(0.37 \leq Z) = 1 - A_1 = 1 - 0.6443 = 0.3557$



3. (22pts) The warranty on a car battery is 48 months. Assume the breakdown times are normally distributed with mean 57 months and standard deviation of 8 months. Draw a picture showing which area you are computing as you answer:

- What percentage of batteries will require replacement under warranty?
- What percentage of batteries will last to at least 72 months?
- What percentage of batteries will last between 42 and 54 months?

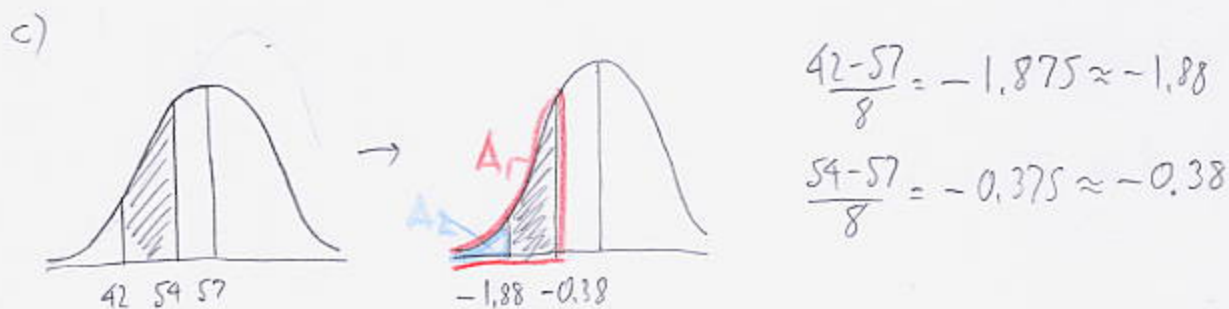
$$z = \frac{X - \mu}{\sigma}$$



$$P(X \leq 48) = A(z \leq -1.13) = 0.1292 \quad \text{or } 12.92\%$$



$$P(72 \leq X) = A(1.88 \leq z) = 1 - A_1 = 1 - 0.9699 = 0.0301 \quad \text{or } 3.01\%$$



$$P(42 \leq X \leq 54) = A(-1.88 \leq z \leq -0.38) = A_1 - A_2 = 0.3520 - 0.0301$$

$$= 0.3219 \quad \text{or } 32.19\%$$