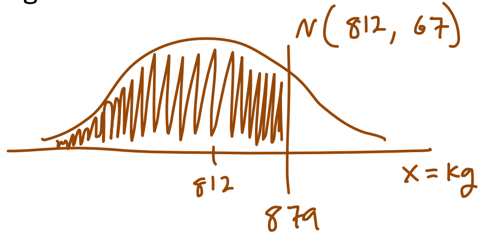
AP Statistics
Normal Model Examples

To get credit for a normal model calculation, you must show:
1) Shaded sketch of the normal curve with Normal Model notation: *N*(mu, sigma)
2) Calculation(s) of the z-scores for the cut-off(s)
3) The correct probability/proportion/percentage. *(you may use either the z-table or "NormalCDF" on your calculator)*

Adult FEMALE walrus weights are approximately normally distributed, with a mean of 812 kg, and a standard deviation of 67 kg. If we select an adult female walrus at random, what is the probability that her weight is...

a) less than 879 kg?

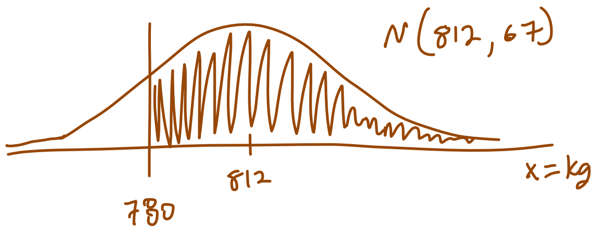


$z = \frac{x - \mu}{\sigma} = \frac{879 - 812}{67} = 1.00$

☆ For a "less than" probability, look up 1.00 on the z-table:

$P(\text{weight} < 879) = \boxed{0.8413}$

b) more than 780 kg?



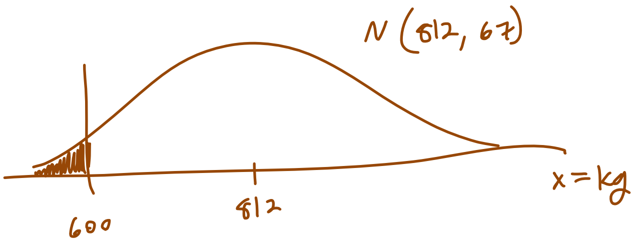
$z = \frac{x - \mu}{\sigma} = \frac{780 - 812}{67} = -0.478$

(round to 2 places for z-table)

☆ For a "greater than" problem, find the probability on the z-table, then subtract from 1.0:

$1 - 0.3156 = \boxed{0.6844}$

c) less than 600 kg?

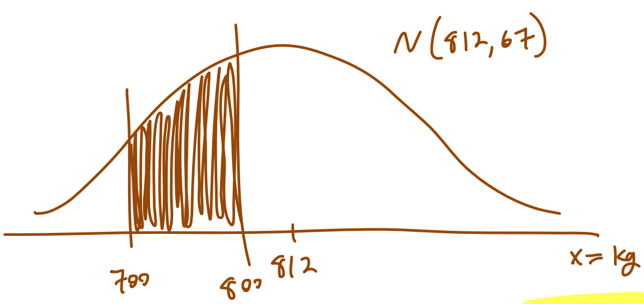


$z = \frac{600 - 812}{67} = -3.16$

$P(z < -3.16) = \boxed{0.0008}$

again, this is from the z-table

d) between 700 and 800 kg?



700 $z = \frac{700 - 812}{67} = -1.67 \rightarrow 0.0475$

☆ look up both on z-table

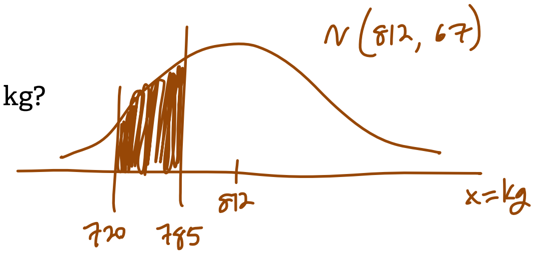
800 $z = \frac{800 - 812}{67} = -0.179 \rightarrow 0.4286$

(or −0.18)

☆ For a "between" problem, subtract the 2 probabilities:

$0.4286 - 0.0475 = \boxed{0.3811}$

e) between 720 kg and 785 kg?



$P(720 < \text{weight (kg)} < 785)$

$= 0.3446 - 0.0853$

$= \boxed{0.2593}$

$z = \frac{720-812}{67} = -1.37 \rightarrow 0.0853$

$z = \frac{785-812}{67} = -0.40 \rightarrow 0.3446$

(Now we are using the Normal model in REVERSE…)

f) Approximately what weight represents the cut-off for the TOP 5% of adult female walrus weights?

Find the z-score that gives you 0.9500… (or as close as possible) $z = 1.645$ (or 1.64 or 1.65)

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

$1.645 = \frac{x-812}{67}$ (algebra) $\Rightarrow$ $\boxed{x = 922.215 \text{ kg}}$

g) Approximately what weight represents the cut-off for the BOTTOM 20% of adult female walrus weights?

Find z-score for 0.2000… $z = -0.84$

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

$-0.84 = \frac{x-812}{67}$

⋮

$\boxed{x = 755.72 \text{ kg}}$

*h) What is the IQR for adult female walrus weights?

Q3 − Q1

Q3) 75th percentile: $z = +0.67$

Q1) 25th percentile: $z = -0.67$

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

$0.67 = \frac{x-812}{67}$

⋮

$x = 856.89$ ← Q3

$-0.67 = \frac{x-812}{67}$

⋮

$x = 767.11$ ← Q1

$IQR = Q3 - Q1$

$= 856.89 - 767.11$

$= \boxed{89.78 \text{ kg}}$

i) 6-month old male babies have a mean weight of 16.5 pounds. Suppose a certain 6-month old baby boy weighs 20 pounds – this places him at the 95th percentile for babies his age! What is the standard deviation of weights for male babies at 6 months of age? Assume that these weights are approximately normally distributed. *(hint: start by finding the z-score for the 95th percentile…)*

$z = 1.645$ ish

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

$1.645 = \frac{20-16.5}{\sigma}$

⋮

$\boxed{\sigma = 2.13 \text{ pounds}}$