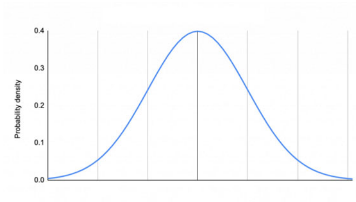
ACTIVITY 14 For each question where applicable 1) shade the normal distribution, 2) state the function you use (pnorm, qnorm, pt, qt) 3) state the answer.

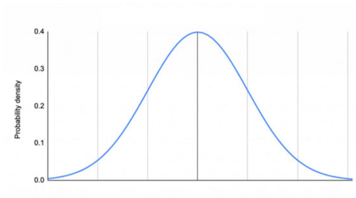
Part 0 In class examples

Example 1: Calculate the probability of being LESS THAN 1 std dev BELOW the mean.



COMPLETED IN CLASS

Example 2: Find the STAT (CV) for being in the highest 30%.



COMPLETED IN CLASS

Example 3: The amount of money spent buying weekly groceries follows a normal distribution. We are lucky enough to know the population mean is \$150 and the population standard deviation is \$20. Find the probability an individual spent less than \$120.

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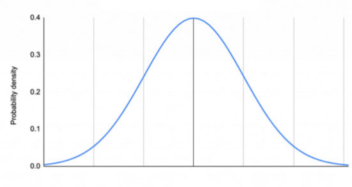
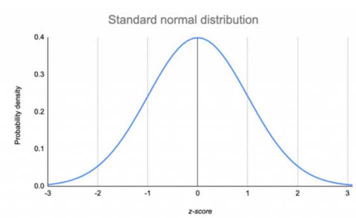




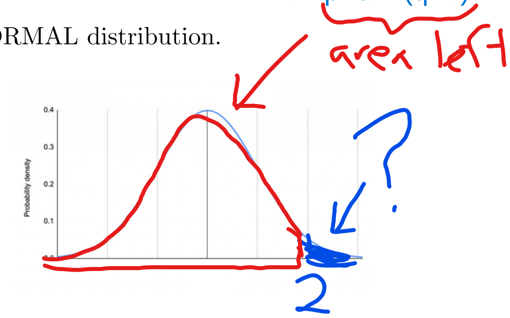
Alt solution
1 - pnorm(q=2)

Part 1 The following set of questions are using the STANDARD NORMAL distribution.

a) What is the probability of being more than two standard deviations above the mean (STAT = 2)?

pnorm(q = 2, lower.tail = FALSE)

0.02275 or 2.28%



b) 30% of our data is below what STAT (critical value)? (ie: is how many standard deviations below the mean?)

qnorm(p = 0.3)

-0.52 ie: 0.52 standard deviations LESS than the mean

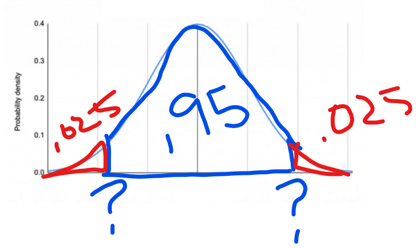
Total area = 1

c) 95% of our data is between what two STAT (critical values)?

qnorm(p = 0.025) = -1.96

qnorm(p = 0.025, lower.tail = FALSE) area to right
OR qnorm(p = 0.975) area to left

+1.96



Draw a picture! To solve for the "?"
we need the area to the left!
1- 0.95 = 0.05 So how much is in each tail? 0.025

Part 2 Now let's compare the spread of a standard normal distribution to a t-distribution.

pt(q = 1.96, df = 10)

0.9608

a) Consider a t-distribution with $df = 10$. What percent of our data is between the STAT values -1.96 and 1.96?

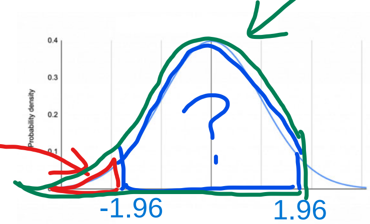
Area to left 1.96 - Area to left of -1.96

0.9608 - 0.0392

= 0.92156 area in middle

pt(q = -1.96, df = 10)

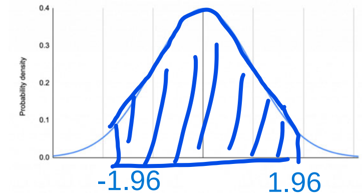
0.0392



b) Consider a t-distribution with $df = 30$. What percent of our data is between the STAT values -1.96 and 1.96?

Same as above:
pt(q = 1.96, df = 30) - pt(q = -1.96, df = 30) = 0.9407

Alternate solution: 1- left tail - right tail

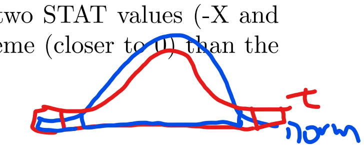


c) How do the percents in 2a and 2b compare to the normal distribution in 1c? In other words, how does the distribution change as sample size increases?

The percents are smaller for 2a and 2b than in 1c. That is because a t-distribution has a fatter tail.
As df gets bigger the percent will get closer and closer to the answer to 1c.

Consider a t-distribution with df=10 and we find that 95% of our data is between two STAT values (-X and X). Will the STAT values (-X and X) be more extreme (farther from 0) or less extreme (closer to 0) than the STAT values from 1c?

The STAT values will be MORE EXTREME for the t-dist with 10 df



Part 3 The scores on SAT scores are normally distributed with a mean of 1050 and a sd of 200.

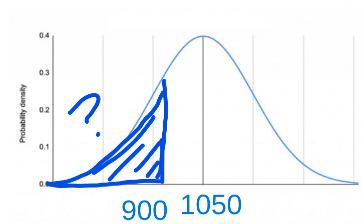
a) Using the empirical rule, 68% of SAT scores are between what two values?

1050 -200 and 1050+200
= 850 and 1250

b) What percent of students score lower than 900?

pnorm(q=900, mean = 1050, sd = 200)

pnorm(q = -0.75) 22.66%



c) In order to get into the University your SAT score must be in the top 15% of all students. What is the lowest SAT score you can get to be accepted?

qnorm(p=0.15, mean = 1050, sd = 200, lower.tail = FALSE)

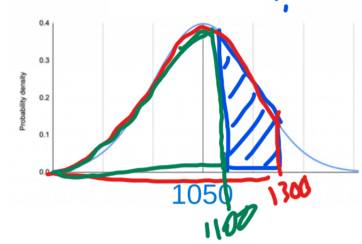
1257.29

d) What proportion of students score between 1100 and 1300 on the SAT?

pnorm(q=1300, mean = 1050, sd = 200) = 0.89435

pnorm(q=1100, mean = 1050, sd = 200) = 0.5987

0.8944-0.5987 29.56%



Part 4: Standardization

The weight of male elephants follows a normal distribution with an average of 9,000 pounds and standard deviation of 1,300 pounds. The weight of female elephants follows a normal distribution with an average of 7,000 pounds and standard deviation of 1,000 pounds.

- Mabu is a male elephant that weighs 13,015 pounds.
- Nandi is a female elephant that weighs 3,585 pounds.

Whose weight is more extreme?

Mabu $\frac{13015 - 9000}{1300} = 3.088$

Nandi $\frac{3585 - 7000}{1000} = -3.4$

Nandi
because STAT is farther from 0