Unit 11 Test Study Guide
(Probability & Statistics)

Name: _____

Date: _____ Block: _____

Topic 1: Fundamental Counting Principle, Permutations, & Combinations — ordered! — NO order

1. There are ten questions on Jack's science quiz: six multiple choice questions with four choices each and four true/false questions. How many ways can he answer the questions?

4 4 4 4 4 4 2 2 2 2

$65{,}536 = 4^6 \cdot 2^4$

2. The Sandwich Shop offers combo meals with a choice of one sandwich, one side, and one drink. In total, there are 560 combos available. If there are 16 sandwiches and 5 drinks available, how many sides are there?

$16 \cdot 5 \cdot x = 560$

$\frac{80x}{80} = \frac{560}{80}$

$x = 7$

Determine whether the situation represents a permutation or combination, then solve.

3. Marlena must answer three out of eight essay questions on her writing test. How many ways can she choose 3?

$_8C_3 = 56$

4. The Grandview High School Band plans to play six pieces of music in their upcoming concert. How many ways can they arrange the order of their performance?

$_6P_6 \rightarrow 6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$

5. How many ways can a president, vice president, and treasurer be elected from a group of 40 students?

$_{40}P_3 = 59{,}280$

6. Josh must submit 4 paintings as part of his application to art school. If he has 25 to choose from, how many ways can he pick 4?

$_{25}C_4 = 12{,}650$

7. How many different 12-letter arrangements can be made using the letters in the word CARELESSNESS?

$\frac{12!}{3!4!} = 3{,}326{,}400$

8. The field hockey coach chooses players to put away equipment after each practice. If there are 16 players on the team, how many ways can she choose five?

$_{12}C_5 = 4{,}368$

Topic 2: Theoretical Probability/Independent vs. Dependent Events

9. Kate is randomly choosing a date in the month of August. What is the probability that she chooses a two-digit number or a prime number?

August 31 days

1 ... 9, 10 ... 31

22 (double digits)

prime: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31

$\frac{26}{31}$

10. Erik is randomly choosing a card from a standard deck. What is the probability that he chooses a card that is red and a multiple of three?

3 6 9

3 6 9

$\frac{6}{52} = \frac{3}{26}$

11. One of the 50 states is chosen at random. What is the probability of not choosing a state that begins with the letter N?

Nebraska, North Dakota, New York, North Carolina, New Mexico, Nevada, New Jersey, New Hampshire

how many start with N?

$1 - \frac{8}{50} = \frac{42}{50} = \frac{21}{25}$

12. Tony's wallet contains six $1 bills, four $5 bills, two $10 bills, and three $20 bills. If Tony randomly removes a bill, what is the probability that it is at least $5?

1 1 1 1 1 1 5 5 5 5 10 10 20 20 20

at least 5 / total bills: $\frac{9}{15} = \frac{3}{5}$

13. A number 1-30 is randomly selected, followed by a letter from the word TARGET. What is the probability of choosing a perfect square then the letter T?

$\frac{5}{30} \cdot \frac{2}{6} = \frac{1}{18}$

1, 4, 9, 16, 25 perfect squares up to 30

t's in target

14. Carter is handing out Valentine's Day cards to his friends. He has 8 Batman cards, 12 Superman cards, and 5 Captain American cards in a bag. What is the probability that the first two he chooses are Batman?

total = 25

$\frac{8}{25} \cdot \frac{7}{24} = \frac{7}{75}$

1st choice: $\frac{8}{25}$ 2nd choice: $\frac{7}{24}$ left

Topic 3: Conditional Probability

19. Mason randomly chooses a card from a standard deck of playing cards. What is the probability that it is not an ace, given it is a red card?

26 - 2 aces → 24 not aces / 26 red = (12/13)

20. One of the 50 United States is randomly selected. What is the probability that it has two syllables, given it starts with the letter M?

montana, michigan, minnesota, maine, massach, maryland, mississippi, missouri

0/8 = 0

21. Of the 318 sophomores, 140 are taking Algebra 2 and 102 are taking Chemistry. Twenty-six of those taking Algebra 2 are also taking chemistry. If a sophmore is chosen at random, find the probability that they are taking Algebra 2, if it is known that they do not take Chemistry.

114/216 = (19/36)

22. A group of cell phone owners were asked whether they had an Android or apple phone. Use the results in the table to find each probability.

	Male	Female	
Android	34	19	53
Apple	30	42	72
	64	61	125

a) P(a male that owns an android)

34/125

b) P(apple | male)

30/64

c) P(female | android)

19/53

23. The table below shows the number of gold, silver, and bronze medals won by the United States and China during the 2012 summer Olympics. Find the joint relative and marginal relative frequencies

	U.S.	China
Gold	46	38
Silver	28	28
Bronze	29	22

total: 191

	U.S.	China	Total
Gold	24.08%	19.90	43.98
Silver	14.66	14.66	29.32
Bronze	15.18	11.52	26.70
Total	53.92	46.08	100%

191 → 95

If a medal from those above is randomly selected, find each probability.

a) P(a U.S. bronze medal)

15.18% / 100 = 15.18%

b) P(a gold or silver medal)

43.98 + 29.32 = 73.3%

c) P(silver | China)

14.66 / 46.08 = .3181 = 31.81%

d) P(U.S. | gold)

24.08 / 43.98 = 54.75%

e) P(China | not silver)

china: 19.90 + 11.52 = 31.42

not silver: 43.98 + 26.70 = 70.68

= 44.45%

f) P(bronze | not China)

→ all US

15.18 / 53.92 = 28.15%

Topic 4: Binomial Probability & Binomial Theorem

n = # of chances r = want probability = p q = not p

Use for questions 24-27: The soda company is printing prizes on the inside of their bottle caps, with a 3 in 5 chance of winning. If Tom purchases a 12-pack of soda, find each probability.

24. *P*(exactly two prizes)

$n=12 \quad r=2 \quad p=\frac{3}{5} \quad q=\frac{2}{5}$

$nCr \cdot p^r \cdot q^{n-r}$

$12C_2\left(\frac{3}{5}\right)^2\left(\frac{2}{5}\right)^{10} = .00249$

.25 %

25. *P*(exactly five prizes)

$12C_5\left(\frac{3}{5}\right)^5\left(\frac{2}{5}\right)^7 = .1009$

10.09 %

26. *P*(at least ten prizes)

$n=12 \quad r=10,11,12 \quad p=\frac{3}{5} \quad q=\frac{2}{5}$

$12C_{10}\left(\frac{3}{5}\right)^{10}\left(\frac{2}{5}\right)^2 = .0639$

$12C_{11}\left(\frac{3}{5}\right)^{11}\left(\frac{2}{5}\right)^1 = .0174$

$12C_{12}\left(\frac{3}{5}\right)^{12}\left(\frac{2}{5}\right)^0 = .0022$ +

.0835 = 8.35 %

27. *P*(no more than three prizes)

$12C_3\left(\frac{3}{5}\right)^3\left(\frac{2}{5}\right)^9 = .0125$

$12C_2\left(\frac{3}{5}\right)^2\left(\frac{2}{5}\right)^{10} = .0025$

$12C_1\left(\frac{3}{5}\right)^1\left(\frac{2}{5}\right)^{11} = .0003$

$12C_0\left(\frac{3}{5}\right)^0\left(\frac{2}{5}\right)^{12} = .0000$ +

.0153

1.53 %

Expand each binomial using the binomial theorem.

28. $(a+2)^9$

$9C_0 \quad 9C_1 \quad 9C_2 \quad 9C_3 \quad 9C_4 \quad 9C_5 \quad 9C_6 \quad 9C_7 \quad 9C_8 \quad 9C_9$

$1a^9 \quad 9a^8(2) \quad 36a^7(2)^2 \quad 84a^6(2)^3 \quad 126a^5(2)^4 \quad 126a^4(2)^5 \quad 84a^3(2)^6 \quad 36a^2(2)^7 \quad 9a^1(2)^8 \quad 1(2)^9$

29. $(4k+1)^5$

$5C_0 \quad 5C_1 \quad 5C_2 \quad 5C_3 \quad 5C_4 \quad 5C_5$

$1(4k)^5 \quad 5(4k)^4 \cdot 1 \quad 10(4k)^3 \cdot 1^2 \quad 10(4k)^2 \cdot 1^3 \quad 5(4k)^1 \cdot 1^4 \quad 1 \cdot 1^5$

$1 \cdot 4^5 \quad 5 \cdot 4^4 \quad 10 \cdot 4^3 \quad 10 \cdot 4^2 \quad 5 \cdot 4^1$

$1024k^5 + 1280k^4 + 640k^3 + 160k^2 + 20k + 1$

Topic 5: Statistics: Measures of Variation, Normal Distribution, and z-Scores

Find the mean absolute deviation, variance, and standard deviation for each data set.

30. The following data represents the last ten field goal attempts, in yards, made by the kicker.
{54, 29, 33, 62, 45, 39, 41, 52, 59, 36}

mean: 45

-45

$9, 16, 12, 17, 0, 6, 4, 7, 14, 9 + = \frac{94}{10}$

average distance from mean (+)

MAD = 9.4

Variance: σ^2 = 114.70

Standard Deviation: σ = $(10.71)^2$

31. The following data shows the grades of the Carl's last 8 quiz grades in Algebra 2.
{72, 93, 52, 86, 100, 81, 79, 61}

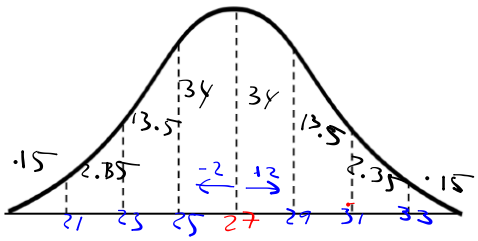
MAD = 11.88

Variance: σ^2 = 222.90

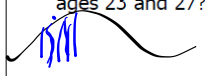
Standard Deviation: σ = 14.93

Label the normal distribution curve, then answer the questions that follow.

The ages of the 32 recruits in police academy are normally distributed with a ~~mean of 27~~ with a standard deviation of 2.

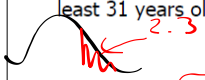


32. What percent of the recruits are between ages 23 and 27?



13.5 + 34 = 47.5%

33. What is the probability that a recruit is at least 31 years old?



2.35 + .15 = 2.5%

34. Approximately how many recruits are at most 29 years old?

50% + 34% = 84%

.84 × 32 = 26.88

26 people

35. The blood pressure of a group of adults is normally distributed with a mean of 122 and a standard deviation of 13. If Mina's blood pressure is 108, find her z-score.

$z = \frac{x - \mu}{\sigma}$ ← mean, ← standard dev.

$z = \frac{108 - 122}{13}$

$z = -1.08$

36. The daily balance of a checking account over the course of a month is normally distributed with a standard deviation of \$84.10. If the balance in the account on a particular day was \$317.34 with a z-score of -2.4, find the mean balance.

$-2.4 = \frac{317.34 - \mu}{84.10}$

$\mu = 519.18$

37. The length of a certain fish species is normally distributed with a mean of 15 cm. If a fish in this species is 18.8 cm with a z-score of 1.9, what is the standard deviation?

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

$1.9 = \frac{18.8 - 15}{\sigma}$

$\frac{1.9}{1.9} = \frac{3.8}{1.9}$

$\sigma = 2$

38. The number of visits to the gym each year by the members at InFit is normally distributed with a mean of 97 and a standard deviation of 25. If Kurt's z-score is -1.8 and Mindy's z-score is 2.4, how many more times did Mindy visit the gym than Kurt?

menu - 6-5-2

Use for questions 39-42: The shoe sizes of the 36 students in Samantha's PE class are normally distributed with a mean of 8.5 and a standard deviation of 1.5.

39. What percent of the students have a shoe size between 7 and 11?

.7936

= 79.36%

lower 7
upper 11
μ 8.5
σ 1.5

40. What is the probability that a student will have a maximum shoe size of 9.5?

.7475

74.75%

lower -99999
upper 9.5
μ 8.5
σ 1.5

9.5

41. Approximately how many students wear at least a size 6?

6 → 99999

95.22%

Low 6
Up 99999
μ 8.5
σ 1.5

42. Approximately how many students wear a shoe size between 8 and 10?