

**Math 112A – Geometry and Applications
Exam Review**

Circle Geometry:

1. Chords that are the same distance from the center of the circle are the same length
2. Chords that are the same length are the same distance from the center of the circle.
3. The perpendicular bisector of a chord goes through the center of the circle
4. The line perpendicular to a chord going through the center of the circle bisects the chord.
5. Radius goes from the center of the circle to the outside of the circle. All radii are equal in length.
6. Diameter is the longest chord in the circle. It is twice the length of the radius.
7. Congruent triangles
 - Proof must include a statement and a reason
 - Begin with the given information (those are the easy points)
 - What information can you figure out from what is shown?
 - Once you have all the necessary parts, make the congruency statement.
8. Parallel lines
 - Slopes are equal
9. Perpendicular lines
 - Slopes are negative reciprocals

10. Calculate slope $m = \frac{y_2 - y_1}{x_2 - x_1}$

11. Calculate distance $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

12. Calculate midpoint $M = \left(\frac{x_2 + x_1}{2}, \frac{y_2 + y_1}{2} \right)$

13. 360° in a circle

14. Measure of the central angle = measure of the arc

15. Measure of the inscribed angle is $\frac{1}{2}$ the measure of the central angle
16. Measure of the central angle is twice the measure of the inscribed angle
17. Central angle has its vertex at the center of the circle.
18. Inscribed angle has its vertex on the circle
19. Opposite angles in a cyclic quadrilateral add to be 180°
20. An angle inscribed in a semi circle (or off the diameter) is 90°
21. A tangent line is perpendicular to the radius drawn to the point of tangency
22. Tangent segments to a circle, from any external point, are equal
23. Inscribed angles subtended by the same arc are equal.
24. The angle between a tangent and a chord is equal to the inscribed angle on the opposite side of the chord.
25. Equation of a circle ($x^2 + y^2 = r^2$)
 - Center, radius
 - Sketch the circle
 - Look at the sketch and write the equation
 - Transformational form
 - Mapping notation
 - General to standard form (completing the square)
 - Standard to general form

Probability:

1. Calculate $p(x)$ and $p(\bar{x})$ (the probability of an event happening and the probability of the event not happening. (complement)

A single die is rolled. The probability of rolling a five is $\frac{1}{6}$. It would be written as $P(5) = \frac{1}{6}$.

Make certain that you reduce fractions as necessary.
2. Theoretical probability vs. experimental probability

The more trials that are performed, the closer the experimental probability gets to the theoretical probability

3. Tree Diagrams

We use a tree diagram when we are asked to list all the possible combinations.

4. Fundamental Counting Principle

Suppose you own 8 shirts, 4 pairs of pants, and 12 pairs of socks. In how many ways can your clothes be combined?

$$8 \times 4 \times 12 = 384 \text{ different ways}$$

5. Independent Events

What is the probability of rolling two fours in a row with a single die?

$$P(4 \text{ and } 4) = P(4) \times P(4) = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$$

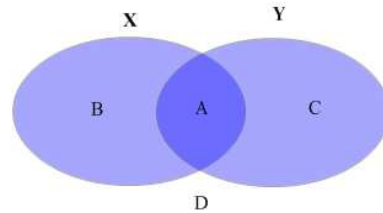
6. Dependent events

A box contains 5 red balls and 3 green balls. Two balls are drawn in succession without replacement. Find the probability of drawing first a red then a green ball.

$$P(RG) = P(R) \times P(G) = \frac{5}{8} \times \frac{3}{7} = \frac{15}{56}$$

7. Venn Diagrams

Region	Properties
A	X and Y
B	X only
C	Y only
D	Neither X nor Y



8. Mutually exclusive/inclusive events (The Addition Principle)

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

What is the probability of drawing a diamond or an ace from a regular deck of cards?

$$P(\text{diamond}) = \frac{1}{4}$$

$$P(\text{ace}) = \frac{1}{13}$$

$$P(\text{diamond, ace}) = P(\text{diamond}) + P(\text{ace}) - P(\text{diamond \& ace})$$

$$= \frac{1}{4} + \frac{1}{13} - \frac{1}{52}$$

$$= \frac{4}{13}$$

***If the events cannot occur at the same time then we subtract 0

9. Factorial Notation

Ex. $5! = 5 \times 4 \times 3 \times 2 \times 1$

10. Recognizing Combinations and Permutations

Permutations – order is important (ex. 1st, 2nd, 3rd place finishers in a race)

Combination – order is unimportant (ex. Choosing 3 people to be on a committee)

11. Calculating Combinations and Permutations

$${}_n C_r = \frac{n!}{(n-r)!r!} \qquad {}_n P_r = \frac{n!}{(n-r)!}$$

12. Pascal's Triangle using combinations

${}_n C_r$, where n represents the row number and r represents one less than the term number

13. Binomial expansion

$$(a+b)^n = {}_n C_0 a^n b^0 + {}_n C_1 a^{n-1} b^1 + \dots + {}_n C_{n-1} a^1 b^{n-1} + {}_n C_n a^0 b^n$$

Sequences and Series:

1. Arithmetic Sequences: $t_n = t_1 + d(n-1)$

- t_1 or a is the first term, d is the difference

$$\text{Arithmetic Series: } S_n = \frac{n}{2}[2a + (n-1)d]$$

2. Geometric Sequences: $t_n = a(r^{n-1})$

- a is the first term, r is the ratio

$$\text{Geometric Series: } S_n = a \frac{(1-r^n)}{1-r}$$

3. Interest

- Simple Interest : $I = Prt$

P = principal r = rate t = time in years

- Compound Interest : $A = P(1+i)^n$

P = principal i = interest rate per period n = number of interest periods

- Present Value: $A = P(1+i)^n$

Solving for P

