MTH 110
Exam 3 Form A
Fall 2025

Formulas and information are given on the last page, which you may detach.

1. Evaluate the factorial expression.

$$\frac{8!}{6!}$$

2. Evaluate the expression.

$${}_9P_4$$

3. Evaluate the expression.

$${}_{11}C_7$$

4. Evaluate the expression.

$$\frac{{}_{12}C_3}{{}_6C_3}$$

5. The model of the car you are thinking of buying is available in eight different colors and three different styles (hatchback, sedan, or station wagon). In how many ways can you design the car?

6. An apartment complex offers apartments with four different options.

Option	Available selections
Bedrooms	one bedroom, two bedrooms, three bedrooms
Bathrooms	one bathroom, two bathrooms
Floor	first floor, second floor, third floor
View	forest view, lake view, golf course view, no special view

If one selection is chosen from each of the four options, in how many ways can an apartment be designed?

7. Suppose you are asked to list, in order of preference, the four best movies you have seen this year. If you saw 21 movies during the year, in how many ways can the four best be chosen and ranked?

8. A five-person committee is to be elected from an organization's membership of 16 people. How many different committees are possible?

9. The last page shows a standard deck of cards.

You are dealt one card from a standard 52-card deck. Find the probability of being dealt a card greater than 2 and less than 7. (Give a simplified fraction.)

10. A single die is rolled twice. The 36 equally likely outcomes are shown as follows.

	Second Roll					
First Roll	⚀	⚁	⚂	⚃	⚄	⚅
⚀	(1, 1)	(1, 2)	(1, 3)	(1, 4)	(1, 5)	(1, 6)
⚁	(2, 1)	(2, 2)	(2, 3)	(2, 4)	(2, 5)	(2, 6)
⚂	(3, 1)	(3, 2)	(3, 3)	(3, 4)	(3, 5)	(3, 6)
⚃	(4, 1)	(4, 2)	(4, 3)	(4, 4)	(4, 5)	(4, 6)
⚄	(5, 1)	(5, 2)	(5, 3)	(5, 4)	(5, 5)	(5, 6)
⚅	(6, 1)	(6, 2)	(6, 3)	(6, 4)	(6, 5)	(6, 6)

Find the probability of getting two numbers whose sum is 5. (Give a simplified fraction.)

11. The table shows the distribution, by age, of a random sample of 4000 American moviegoers ages 12 through 74. Use this distribution to solve the given problem.

Ages	Number
12–24	300
25–44	1680
45–64	1840
65–74	180

If one moviegoer is randomly selected from this population, find the probability, expressed as a simplified fraction, that the moviegoer is not in the 25–44 age range. (Give a simplified fraction.)

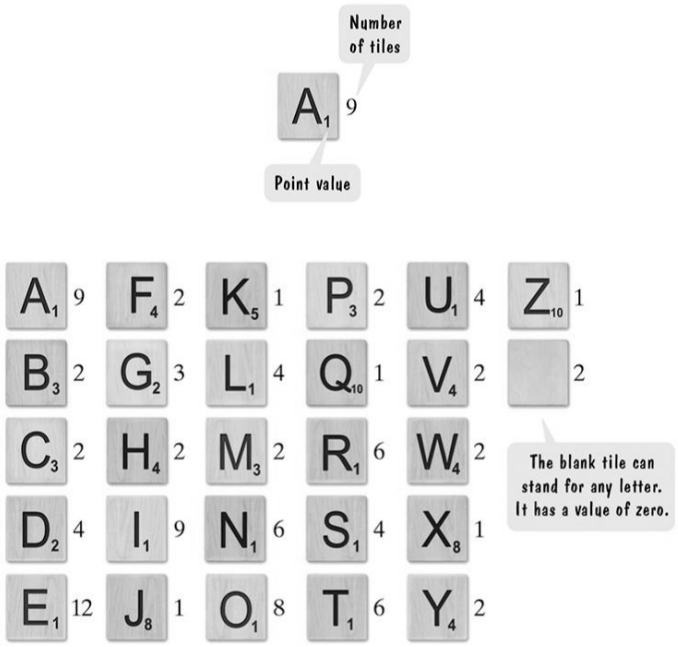
12. The last page shows a standard deck of cards.

You randomly select one card from a 52-card deck. Find the probability of selecting a red 5 or a black 6. (Give a simplified fraction.)

13. The last page shows a standard deck of cards.

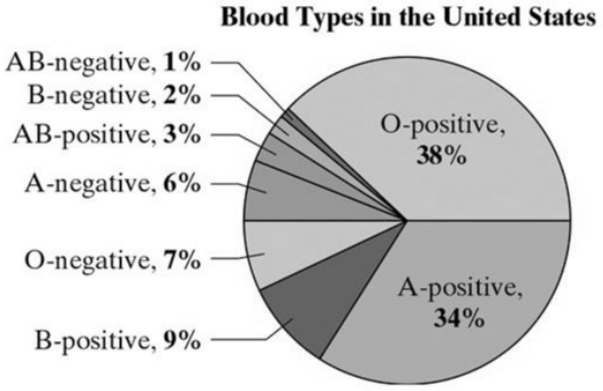
You are dealt one card from a 52-card deck. Find the probability that you are dealt a club or a picture card. (Give a simplified fraction.)

14. The game of Scrabble has 100 tiles. The diagram shows the number of tiles for each letter and the letter's point value.



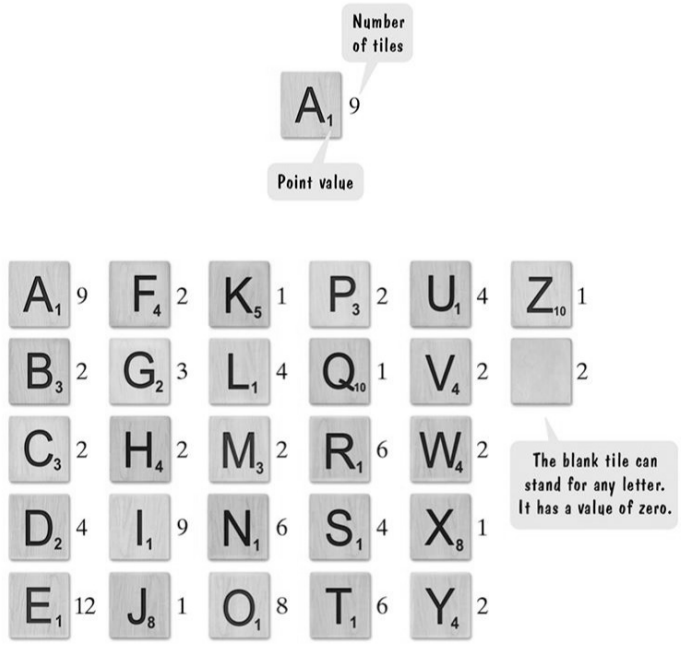
Find the probability of selecting one of the letters needed to spell the word GOAL. (Give a simplified fraction.)

15. Every person has one of eight blood types, determined by molecules on the surface of their red blood cells. Individuals can only receive specific blood types, usually the one that matches their own. Use the circle graph showing the percentage of individuals with each blood type to answer the given question.



What are the odds in favor of randomly selecting an individual with blood type A-negative? (Express your answer as a simplified ratio.)

16. The game of Scrabble has 100 tiles. The diagram shows the number of tiles for each letter and the letter's point value.



One tile is drawn from Scrabble's 100 tiles. Find the odds in favor of selecting an N. (Express your answer as a simplified ratio.)

A standard deck of cards has 52 cards.

A♠	2♠	3♠	4♠	5♠	6♠	7♠	8♠	9♠	10♠	J♠	Q♠	K♠
A♡	2♡	3♡	4♡	5♡	6♡	7♡	8♡	9♡	10♡	J♡	Q♡	K♡
A♢	2♢	3♢	4♢	5♢	6♢	7♢	8♢	9♢	10♢	J♢	Q♢	K♢
A♣	2♣	3♣	4♣	5♣	6♣	7♣	8♣	9♣	10♣	J♣	Q♣	K♣

There are 4 suits: spades ♠, hearts ♡, diamonds ♢, clubs ♣.
There are 13 ranks in each suit: Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King.

The Jack, Queen, and King are called picture cards, or face cards.
The spades ♠ and clubs ♣ are black.
The hearts ♡ and diamonds ♢ are red.

$$ {}_nP_r = \frac{n!}{(n-r)!} $$

$$ {}_nC_r = \frac{n!}{(n-r)!\,r!} $$

$$ P(\text{not } E) = 1 - P(E) $$

If it is impossible for events A and B to occur simultaneously, the events are said to be **mutually exclusive**.

$$ P(A \text{ or } B) = P(A) + P(B) \quad (\text{if } A \text{ and } B \text{ are mutually exclusive}) $$

$$ P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) \quad (\text{if } A \text{ and } B \text{ are not necessarily mutually exclusive}) $$

$$ \text{Odds in favor of } E \ = \frac{P(E)}{P(\text{not } E)} \qquad (\text{expressed as a ratio}) $$

$$ \text{Odds against } E \ = \frac{P(\text{not } E)}{P(E)} \qquad (\text{expressed as a ratio}) $$