

### Special Angles, Permutations and Combinations

Please read through the test carefully. Clearly mark your choice on any multiple-choice questions and indicate your final answer on any other type of question. Any work can be completed on additional paper and included with the test. **Good luck!**

1. Find the numerical value of each expression without a calculator. Please indicate all the steps you took and show your exact answer. Simplify if necessary.

A  $\frac{3}{1 - 2\sin 45^\circ}$

B  $\frac{\sin(-120^\circ)}{\sin(-135^\circ) - \sin(60^\circ)}$

C  $\frac{\sin^2 135^\circ}{8\sin(120^\circ) + 5}$

D  $\frac{\sin 225^\circ}{\cos 60^\circ} + \frac{\sin 45^\circ}{\cos 120^\circ}$

E  $\frac{6\cos 60^\circ}{3 - 4\cos(-45^\circ)}$

2. The expression  ${}_{20}P_4$  could be used to solve which of the following scenarios?
- A There are 240 students in the school. All must sign up for 4 volunteer activities during the year. There are 20 possible activities. How many students can participate in any one activity?
  - B The band teacher must determine the exact number of students needed for next year's band. He must be able to form 20 groups with 4 students in each group. How many band members must he have in order to do this?
  - C There are 20 children entered in the school relay. Prizes will be awarded for 1st through 4th place. How many possible arrangements of the four winners is possible?
  - D Marissa wants to find how many different ways the letters in her name can be arranged. Using the letters from her first and last name, there are 20 total letters. Four of those letters are repeated 2 times. How many possible combinations of letters are there?
3. The graduating class has a total of 166 students. They are voting for a president, vice-president, and treasurer. Which of the following expressions would be used to determine the number of possible outcomes exist?
- A  $166! - 3!$
  - B  ${}_{166}P_3 - {}_3C_{166}$
  - C  ${}_3P_{166}$
  - D  ${}_{166}P_3$
4. Justine's ipod randomly selects the order in which her songs will be played. There are 9 songs in the play list she is currently playing. Which of the following will tell us how many different orders there are for the songs?
- A  $9!$
  - B  $9! - 2!$
  - C  ${}_9C_9$
  - D  ${}_9P_2$
5. Using the digits 1, 2, 4, 6, and 8 to create 2-digit numbers, how many numbers are possible? You may not repeat a digit (example: 22, 44 are not acceptable).
- A  ${}_5P_4$
  - B  ${}_5C_4$
  - C  ${}_5C_2$
  - D  ${}_2P_5$
6. Which of the following equations is TRUE?
- A  $1! + 2! + 3! = 6!$
  - B  ${}_6C_2 = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2$
  - C  $6! \div 4! = 6 \cdot 5$
  - D  ${}_{19}P_{19} = 19 \cdot 19$

7. Which of the following equations answers the question, "How many different ways can you arrange 7 people in a line?"

A  ${}_7P_7 = 7! - 1! = 6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$

B  ${}_7P_7 = \frac{7!}{(7-7)!} = \frac{7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{0!} = 5040$

C  ${}_7P_7 = 7^2 = 49$

D  ${}_7P_7 = 823,543$

8. PoPo wants to buy the new Z-2, an economical sports car. The car comes in 7 colors; 2 body styles; and two engine types. How many possible combinations or choices are there for the Z-2?

A 28

B 56

C 210

D 1,260

9. What does the expression  ${}_8C_2$  mean?

A The number of possible outcomes when 8 items are taken 2 at a time; order is important.

B The number of possible outcomes when 8 items are divided into 2 equal groups; order is important.

C The number of possible outcomes when 8 items are taken 2 at a time; order is not important.

D The number of possible outcomes when 8 items are divided into 2 unequal groups; order is not important.

10. Clarke is craving pie from Sweet Indulgence. He arrives at the store to see that there is a special combo. He has the option of 10 different pies that can be paired with 6 different coffees and 24 different flavours of ice cream. How many possible combinations could Clarke choose?

11. You have been asked to design a new provincial license plate for the Nova Scotia Department of Motor Vehicles. Your plate must include 3 alpha characters followed by 3 numeric characters (alpha and numeric characters can be repeated on a plate).

A How many possible arrangements exist for the numeric characters?

B How many possible outcomes are there for the alpha characters?

**C** How many possible license plates can be created following the specified requirements?

**D** Assuming you could only use a character one time on any one plate, which of the following expressions can be used to determine how many possible arrangements there are?

**A**  ${}_{10}P_3$  **X**  ${}_{26}P_3$

**B**  ${}_{10}C_3$  **X**  ${}_{26}C_3$

**C**  ${}_{26}C_{10}$  **X**  ${}_{10}C_{26}$

**D**  ${}_{26}P_{10}$  **X**  ${}_{26}P_{10}$

**12.** An airline overbooked one of its flights. There are only 2 seats left on the plane, but Phil, Nicky, Jade, Zara, Eric and Elliott all need to get on. If the airline puts the 6 names in a hat and randomly draws 2 names, which expression will allow us to determine how many possible pairs of passengers can be made?

**A**  ${}_6P_2$

**B**  ${}_6C_2$

**C**  ${}_2P_6$

**D**  ${}_2C_6$

**BONUS:** If there were only 2 seat and Phil, Nicky, Jade, Zara, Eric and Elliott were left, who would REALLY get the seats and why?

**Multiple Choice/Short Answer Key**

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_

8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_

11. A \_\_\_\_\_

12. \_\_\_\_\_

B \_\_\_\_\_

C \_\_\_\_\_

D \_\_\_\_\_

Bonus: \_\_\_\_\_