The Counting Principle and Permutations (Key)
Algebra 2

Evaluate each factorial.

1) 2! = 2

2) 3! = 6

3) 4! = 24

4) 5! = 120

Write out the following factorials and show the canceling.

5) 9!/6!

$$\frac{9\cdot8\cdot7\cdot6\cdot5\cdot4\cdot3\cdot2\cdot1}{6\cdot5\cdot4\cdot3\cdot2\cdot1}$$

6) 10!/8!

$$\frac{10\cdot9\cdot8\cdot7\cdot6\cdot5\cdot4\cdot3\cdot2\cdot1}{8\cdot7\cdot6\cdot5\cdot4\cdot3\cdot2\cdot1}$$

7) 7!/5!

$$\frac{7\cdot6\cdot5\cdot4\cdot3\cdot2\cdot1}{5\cdot4\cdot3\cdot2\cdot1}$$

8) 9!/7!

9) 10!/10!

10) 6!/4!

AS ABOVE

Evaluate.

11) 8!/4!

8•7•6•5

= 1,680

12) 7!/6!

= 7

13) 6!/3!

= 6•5•4

= 120

14) 9!/4!

=9•8•7•6•5

= 15,120

15) 9!/5!

9•8•7•6 =

= 3,024

Write in terms of factorials.

16) 100 x 99 x 98 x 97 = $=\frac{100!}{96!}$

17) 31 x 30 x 29 = $=\frac{31!}{28!}$

18) 45 x 44 x 43 x 42 x 41= $=\frac{45!}{40!}$

19) 3 x 2 x 1 = 3!

20) 8 x 7 x 6 = $=\frac{8!}{5!}$

21) If you have 3 pairs of shoes, 2 pairs of pants, and 4 shirts, how many ways can you get dressed?

3 x 2 x 4 = 24 outfits

22) At Kinko's you can choose, white, buff, blue, green, yellow, pink, or goldenrod paper. You want to copy a 6 page history paper. How many color combinations can you make?

$7 \times 7 \times 7 \times 7 \times 7 \times 7 = 7^6$

=117,649 color combinations

23) You take an eight problem multiple-choice quiz. Each question has 4 answer choices. How many ways can you fill out the answer sheet?

$8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 \times 8 = 4^8$

$= 65{,}536$ possible answer combinations

24) You are baking a cake, but for the salt, baking soda, and baking powder you can't tell if it is calling for teaspoons or tablespoons. How many different possible recipes are there?

$2 \times 2 \times 2 = 8$ recipes

25) A penny, a nickel, a dime, and a 6 sided die are tossed. How many results are possible?

$2 \times 2 \times 2 \times 6 = 48$ different result arrangements

26) Seven students are to play the piano at a rehearsal. Two of the students are prima donnas, and one insists on being first while the other insists on being last. If their requests are granted, how many ways can the show be ordered.

$1 \times 5 \times 4 \times 3 \times 2 \times 1 \times 1$

$= 120$ arrangements

Permutations

27) How many ways can you choose the top 5 of 50 players on a basketball teams?

$50 \times 49 \times 48 \times 47 \times 46 =$

254,251,200 ways to pick 5 players

28) You're playing a slot machine in Vegas (and not winning, by the way). If each wheel has 10 pictures, and there are 3 wheels, how many sequences of pictures are there?

$10 \times 10 \times 10$

$= 1000$ picture sequences

29) How many ways can your ipod play a playlist of 12 songs on shuffle, if every song gets played before any song gets played twice?

$12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$=479{,}001{,}600$ song arrangements

30) You've read 100 books since entering high school. Your friend wants you to choose and rank your top 3. How many ways can this be done?

$100 \times 99 \times 98$

$= 970{,}200$ rankings

Evaluate.

31) P(5, 2) $P = \frac{5!}{3!} = 20$

32) P(6, 1) $P = \frac{6!}{5!} = 6$

33) P(7, 4) $P = \frac{7!}{3!} = 840$

34) P(3, 2) $P = \frac{3!}{1!} = 6$

35) P(8, 3) $P = \frac{8!}{5!} = 336$

36) P(10, 2)

$$P = \frac{10!}{8!} = 90$$

37) P(9, 3)

$$P = \frac{9!}{6!} = 504$$

38) P(100, 4)

$$P = \frac{100!}{96!} = 94{,}109{,}400$$

39) P(56, 5)

$$P = \frac{56!}{51!} = 458{,}377{,}920$$