Th: Gr 8 Camp
    Work on Lesson #5

next
Tu: Go over #5
    Start #6
    Project outline

Permutations: Order matters
    (Done!)

Combinations: Order does NOT
    matter (new!)

Ex In English class, there are 4
books you can read (A, B, C, D).
You read 1 book in term 1, and
a different book in term 2.

a) How many choices do you have for
the reading order?

Permutation
(Order matters)

$$\underline{\textcircled{4}} \times \underline{\textcircled{3}} = \underline{12}$$
   term 1   term 2

$$4P_2 = \underline{12}$$

4 2 ___

```
AB    DA    CD
BA    AD    DC
AC    BC    BD
CA    CB    DB
```

b) For term 3, you write an essay comparing your two books. How many different pairs of books are there?

Combination

Order does not matter

```
AB    DA    CD
BA    AD    DC
AC    BC    BD
CA    CB    DB
```

$$\Rightarrow 6 = \frac{12}{2!}$$

Part 3: Five students, Al, Byron, Colin, Dave and Eric take part in a cross country race to represent their school.

a) Suppose the winner of the race wins $50, the runner-up wins $25, and third place runner wins $10.

[handwritten: 1st, 2nd, 3rd, Perm]

The table below shows all possible ways in which the three prizes could be awarded to the five participants in the race.

"A" stands for Al, "B" for Byron, "C" for Colin, "D" for Dave, "E" for Eric.

ABC	ABD	ABE	ACD	ACE	ADE	BCD	BCE	BDE	CDE
ACB	ADB	AEB	ADC	AEC	AED	BDC	BEC	BED	CED
BAC	BAD	BAE	CAD	CAE	DAE	CBD	CBE	DBE	DCE
BCA	BDA	BEA	CDA	CEA	DEA	CDB	CEB	DEB	DEC
CAB	DAB	EAB	DAC	EAC	EAD	DBC	EBC	EBD	ECD
CBA	DBA	EBA	DCA	ECA	EDA	DCB	ECB	EDB	EDC

• Is this an example of permutations or combinations? *[handwritten: Permutation]*

• How many ways are there to award the three prizes?

$$\frac{5}{1st} \times \frac{4}{2nd} \times \frac{3}{3rd} = 60 = {_5}P_3$$

b) For participating in the cross-country race, the school has been awarded three places at a running clinic. The school coach decides to select the 3 lucky students from the ones who took part in the cross country race.

• Use the table from a) (which has been duplicated below) to circle the different ways the three students can be chosen.

ABC	ABD	ABE	ACD	ACE	ADE	BCD	BCE	BDE	CDE
ACB	ADB	AEB	ADC	AEC	AED	BDC	BEC	BED	CED
BAC	BAD	BAE	CAD	CAE	DAE	CBD	CBE	DBE	DCE
BCA	BDA	BEA	CDA	CEA	DEA	CDB	CEB	DEB	DEC
CAB	DAB	EAB	DAC	EAC	EAD	DBC	EBC	EBD	ECD
CBA	DBA	EBA	DCA	ECA	EDA	DCB	ECB	EDB	EDC

• Is this an example of permutations or combinations? *[handwritten: order doesn't matter]*

• How many ways are there to select the three students?

$$10 = \frac{60}{3!} = \frac{60}{6}$$

c) Complete the following statement:

• The number of combinations is equal to the number of permutations divided by __6__ or __3__ factorial. *[handwritten: 60]*

For Combinations, we have
a formula like $_nP_r$.

If we have 'n' things and
we choose 'r' of them
⎿ order doesn't matter

$$\text{total choices} = {}_nC_r = \frac{{}_nP_r}{r!} = \frac{n!}{(n-r)!\,r!}$$

↑ choose
ⓞ Combination

$\left(\text{also written as } \begin{pmatrix} n \\ r \end{pmatrix}\right)$

Ex For Lotto 649 tickets, you choose 6
different numbers between 1 and 49.
How many tickets are possible?

<u>Combination</u> $_nC_r$

49   6

$$_{49}C_6 = 13,983,816$$