Geometry | Monday 4-22-13 | Class Notes

Ch. 13-1 Permutations and Combinations

Permutations

An arrangement of items when order matters

Ex) seating chart
license plate
"p" = pay attention
to order
or position

Combinations

An arrangement of items when order does not matter

Ex) No seating chart
Memory Aid
"b" = be anywhere

Lets look at permutations first

How many seating charts for this class?

CHOICE 1	CHOICE 2	CHOICE 3	OUTCOME

A — B — C — ABC
A — C — B — ACB

B — A — C — BAC
B — C — A — BCA

C — A — B — CAB
C — B — A — CBA

$3 \cdot 2 \cdot 1 = 6$
CHOICES CHOICES CHOICES OUTCOMES

} FUNDAMENTAL COUNTING PRINCIPLE

! = factorial symbol

(EX) $3! = 3 \cdot 2 \cdot 1 = 6$

LOOK

WARNING!!! $0! = 1$ BY DEFINITION

Suppose you had 7 people but only 3 seats — how many seating charts?

$$\underbrace{7}_{\text{FIRST CHOICE}} \cdot \underbrace{6}_{\text{SECOND CHOICE}} \cdot \underbrace{5}_{\text{THIRD CHOICE}} = 210$$

OR $\dfrac{7!}{4!} = \dfrac{\text{total ways to arrange 7 people}}{\text{total ways NOT used since only 3 chairs are used and } 7-3=4}$ (USED / NOT USED)

FORMULA: P = Permutation

N = total items to arrange

r = number of ways to arrange

Permutation

$$_NP_r = \frac{N!}{(N-r)!}$$

ORDER MATTERS — Pay Attention

(EX) $_7P_3 = \dfrac{7!}{(7-3)!} = \dfrac{7!}{4!}$

$= \dfrac{7\cdot6\cdot5\cdot\cancel{4\cdot3\cdot2\cdot1}}{\cancel{4\cdot3\cdot2\cdot1}}$

$= \boxed{210}$

7 things taken 3 at a time

Combination

$$_NC_r = \frac{N!}{(N-r)!\,r!}$$

ORDER DOES NOT MATTER "be anywhere"

(EX) $_7C_3 = \dfrac{7!}{(7-3)!\,3!}$

$= \dfrac{7\cdot6\cdot5}{\cancel{3\cdot2\cdot1}} = \boxed{35}$

Decide if you are using All the ways to arrange something ⇒ FCP
or if selecting some part of a group ⇒ ${}_nP_r$ or ${}_nC_r$
order? yes — order? no

(Ex) lunch, one of each
3 main dishes, 4 beverages, 3 sides, how many ways?

(Ex) license plate, 3 digits then 3 letters (I, O, Q not used).
How many plates (no blanks).

(Ex) How many ways to select Pres, Vice Pres, secretary from 5 people?

(Ex) Art gallery ⇒ 9 photos, 4 wall spaces. How many ways?

(Ex) Adopt 3 kittens from group of 11.
How many ways?

(Ex) Picking Pres., VP, sec. from 5 candidates

$$_NP_r = \frac{N!}{(N-r)!}$$

$$_5P_3 = \frac{5!}{(5-3)!} = \frac{5!}{2!} = 5 \cdot 4 \cdot 3$$

$$= \boxed{60}$$

(Ex) $_9P_4 \Rightarrow {}_NP_r = \frac{N!}{(N-r)!}$

$$\frac{9!}{(5)!} = 9 \cdot 8 \cdot 7 \cdot 6 =$$

SOHCAHTOA ⇒ finding a missing Angle

inverse functions ⇒ swap x, y
(x: IV, y: DV)

(EX) $f(x) = \{(3,2), (4,1), (2,6)\}$

$f^{-1}(x) = \{(2,3), (1,4), (6,2)\}$

↑ inverse function NOTATION
NOT a negative one exponent

$y = \sin(x)$
y: decimal, x: Angle

$y = \sin^{-1}(x)$
y: Angle, x: decimal

(EX) $\sin(45°) = ?$

$\sin(45°) = .7071$

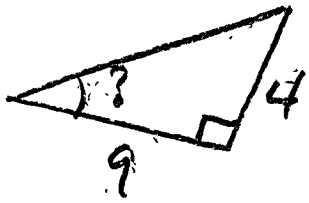
$\sin^{-1}(.7071) = ?$

$\sin^{-1}(.7071) = 45°$

↑ GO BACKWARDS ON TTIG table

Worksheet Practice ⇒ Add/sub Calc. + trig table

(2)



Let ? = x

$\tan x = \frac{4}{9} \approx .4444$

$\tan^{-1}(.4444) \approx 24^\circ$

↑ Nearest degree from trig table

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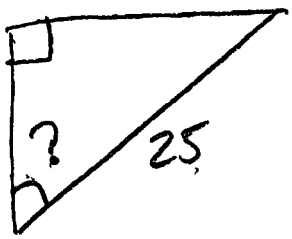
(3)



Let ? = θ

$\sin\theta = \frac{20}{25} = \frac{4}{5} \approx .8000$

$\sin^{-1}(.8000) \approx 53^\circ$

TRIGONOMETRIC RATIOS

Angle	sin	cos	tan	Angle	sin	cos	tan
0°	0.0000	1.0000	0.0000	45°	0.7071	0.7071	1.0000
1°	0.0175	0.9998	0.0175	46°	0.7193	0.6947	1.0355
2°	0.0349	0.9994	0.0349	47°	0.7314	0.6820	1.0724
3°	0.0523	0.9986	0.0524	48°	0.7431	0.6691	1.1106
4°	0.0698	0.9976	0.0699	49°	0.7547	0.6561	1.1504
5°	0.0872	0.9962	0.0875	50°	0.7660	0.6428	1.1918
6°	0.1045	0.9945	0.1051	51°	0.7771	0.6293	1.2349
7°	0.1219	0.9925	0.1228	52°	0.7880	0.6157	1.2799
8°	0.1392	0.9903	0.1405	53°	0.7986	0.6018	1.3270
9°	0.1564	0.9877	0.1584	54°	0.8090	0.5878	1.3764
10°	0.1736	0.9848	0.1763	55°	0.8192	0.5736	1.4281
11°	0.1908	0.9816	0.1944	56°	0.8290	0.5592	1.4826
12°	0.2079	0.9781	0.2126	57°	0.8387	0.5446	1.5399
13°	0.2250	0.9744	0.2309	58°	0.8480	0.5299	1.6003
14°	0.2419	0.9703	0.2493	59°	0.8572	0.5150	1.6643
15°	0.2588	0.9659	0.2679	60°	0.8660	0.5000	1.7321
16°	0.2756	0.9613	0.2867	61°	0.8746	0.4848	1.8040
17°	0.2924	0.9563	0.3057	62°	0.8829	0.4695	1.8807
18°	0.3090	0.9511	0.3249	63°	0.8910	0.4540	1.9626
19°	0.3256	0.9455	0.3443	64°	0.8988	0.4384	2.0503
20°	0.3420	0.9397	0.3640	65°	0.9063	0.4226	2.1445
21°	0.3584	0.9336	0.3839	66°	0.9135	0.4067	2.2460
22°	0.3746	0.9272	0.4040	67°	0.9205	0.3907	2.3559
23°	0.3907	0.9205	0.4245	68°	0.9272	0.3746	2.4751
24°	0.4067	0.9135	0.4452	69°	0.9336	0.3584	2.6051
25°	0.4226	0.9063	0.4663	70°	0.9397	0.3420	2.7475
26°	0.4384	0.8988	0.4877	71°	0.9455	0.3256	2.9042
27°	0.4540	0.8910	0.5095	72°	0.9511	0.3090	3.0777
28°	0.4695	0.8829	0.5317	73°	0.9563	0.2924	3.2709
29°	0.4848	0.8746	0.5543	74°	0.9613	0.2756	3.4874
30°	0.5000	0.8660	0.5774	75°	0.9659	0.2588	3.7321
31°	0.5150	0.8572	0.6009	76°	0.9703	0.2419	4.0108
32°	0.5299	0.8480	0.6249	77°	0.9744	0.2250	4.3315
33°	0.5446	0.8387	0.6494	78°	0.9781	0.2079	4.7046
34°	0.5592	0.8290	0.6745	79°	0.9816	0.1908	5.1446
35°	0.5736	0.8192	0.7002	80°	0.9848	0.1736	5.6713
36°	0.5878	0.8090	0.7265	81°	0.9877	0.1564	6.3138
37°	0.6018	0.7986	0.7536	82°	0.9903	0.1392	7.1154
38°	0.6157	0.7880	0.7813	83°	0.9925	0.1219	8.1443
39°	0.6293	0.7771	0.8098	84°	0.9945	0.1045	9.5144
40°	0.6428	0.7660	0.8391	85°	0.9962	0.0872	11.4301
41°	0.6561	0.7547	0.8693	86°	0.9976	0.0698	14.3007
42°	0.6691	0.7431	0.9004	87°	0.9986	0.0523	19.0811
43°	0.6820	0.7314	0.9325	88°	0.9994	0.0349	28.6363
44°	0.6947	0.7193	0.9657	89°	0.9998	0.0175	57.2900
45°	0.7071	0.7071	1.0000	90°	1.0000	0.0000	∞

(3)

$\sin^{-1}(.8000)$ is closest to $\sin^{-1}(.7986)$

$\therefore \theta = 53^\circ$

(2)

$\tan^{-1}(.4444)$

$\theta = 24^\circ$