$5+8+\ldots+(3n+2)=\frac{n(3n+7)}{2}$ for $n \geq 1$

Check first case(s)

$n=1$

LHS $=5$ RHS $=\frac{1\cdot(3+7)}{2}=5$

$5=5$ ✓

optional $n=2$

LHS $=5+8$
$=13$

RHS $=\frac{2(3\cdot 2+7)}{2}$
$=13$

$13=13$ ✓

Assume $5+8+\ldots+(3n+2)=\frac{n(3n+7)}{2}$ for $1 \leq n \leq k$

So, $5+8+\ldots+(3k+2)=\frac{k(3k+7)}{2}$ ←

LHS: $5+8+\ldots+(3k+2)+(3(k+1)+2)=$

$\frac{k(3k+7)}{2}+(3k+3+2)=$

$\frac{k(3k+7)}{2}+\frac{(3k+5)2}{2}=$

$\frac{3k^2+7k+6k+10}{2}=$

$\frac{3k^2+13k+10}{2}=$

$\frac{(k+1)(3k+10)}{2}=\frac{(k+1)(3k+3+7)}{2}=$

$=\frac{(k+1)(3(k+1)+7)}{2}$

So, by induction, the formula works for all $n \geq 1$

Probability = $\frac{\#\text{ desired outcomes}}{\#\text{ possible outcomes (all equally likely)}}$

15. Sassafras:

$$\frac{\#\text{ "words" w/ s's adjacent \& a's adjacent}}{\#\text{ "words"} \rightarrow 9 \text{ letters, } 4\text{ s's, } 3\text{a's. f, r}}$$

$$\#\text{ words: } \frac{9!}{4!\,3!} \quad (s's, a's)$$

9!

$$\#\text{ words s's adjacent \& a's adjacent.}$$

[s] [a] f r

$$4!$$

$$\text{Probability } \frac{4!}{\left(\frac{9!}{4!3!}\right)}$$

$$= \frac{24}{2520}$$

$$\left(\frac{4!\cdot 4!\cdot 3!}{9!}\right) \quad (s, a)$$

25. 8 tomato plants, 3 diseased

P (diseased together)

A. $\frac{6!}{(8!/3!)}$

H D D H H H D H

H H H D D D H H

B $\frac{6!\ 3!}{8!}$

C. $\frac{6}{C(8,3)}$

A. $\frac{(6!)}{(8!/3!)}$

H_1 H_2 [D] H_3 H_4 H_5

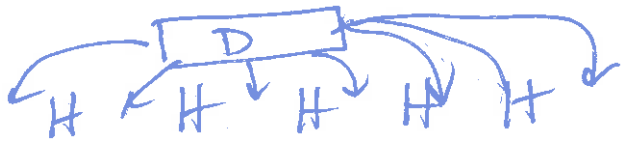
$\frac{8!}{3!}$ ← can switch order of D's & doesn't matter.

B. [DD] H H H H H

mix up D's

$\frac{6!\ 3!}{8!}$ ← mix up 8 plants

C. $\frac{6}{C(8,3)}$ ←



Choose 3 dead ones

D. $\frac{5! \cdot 3! \cdot 6}{8!}$

23. 7F 6S

need 5 P(3F, 2S)

$$\frac{C(7,3)\ C(6,2)}{C(13,5)}$$ ← # 3F, 2S com. / # 5 person coms.

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17. $\frac{1}{5!}$

Induction proof

Combinations & permutations

binary number probs #29

Donut problem: ⟵ come in 4 types. In how many ways can I choose 9.

Pigeonhole principle: Giving books to R, S, T: R gets 4, S gets 3, T gets 2.