Combinations + permutations.

1\. a) $4! = 24$

b) $6! = 720$

c) i. $\binom{28}{2} = 378$ ii. $\binom{28}{3} = 3276$ iii. $\binom{28}{4} = 20475$ iv) $\binom{28}{5} = 98280$

2\.

	1	2	3	4	5	6	7	8	9	10
Tassel of 10 colours										1
" 9 "									1	9
" 8 "								1	8	36
" 7 "							1	7	28	84
" 6 "						1	6	21	56	126
" 5 "					1	5	15	35	70	126
" 4 "				1	4	10	20	35	56	84
" 3 "			1	3	6	10	15	21	28	36
" 2 "		1	2	3	4	5	6	7	8	9
" 1 "	1	1	1	1	1	1	1	1	1	1

(Do you see how this is Pascal's triangle?)

3\. a) $\boxed{6} \times \boxed{5} \times \boxed{4}$ $\dfrac{6 \times 5 \times 4}{3!} = 20.$

b) $\underbrace{\boxed{}\,\boxed{}}_{6} \times \boxed{5}$ $6 \times 5 = 30.$

c) $\underbrace{\boxed{}\,\boxed{}\,\boxed{}}_{6}$ $20 + 30 + 6 = 56.$

d)

1 1 2
1 2 3
1 3 4
2 2 4
1 4 5
2 3 5
1 5 6
2 4 6
3 3 6

4\. a) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 5 & 1 & 4 & 6 & 2 \\ 4 & 5 & 2 & 6 & 3 & 1 \end{pmatrix}$

b) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 1 & 4 & 6 & 5 & 3 \\ 5 & 3 & 4 & 2 & 6 & 1 \end{pmatrix}$

c) $\begin{pmatrix} 3 & 5 & 1 & 4 & 6 & 2 \\ 1 & 2 & 3 & 4 & 5 & 6 \end{pmatrix} = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 6 & 1 & 4 & 2 & 5 \end{pmatrix}$

d) $\begin{pmatrix} 2 & 1 & 4 & 6 & 5 & 3 \\ 1 & 2 & 3 & 4 & 5 & 6 \end{pmatrix} = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 1 & 6 & 3 & 5 & 4 \end{pmatrix}$

e) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 5 & 1 & 4 & 6 & 2 \\ 1 & 6 & 3 & 4 & 2 & 5 \\ 3 & 2 & 1 & 4 & 5 & 6 \\ 1 & 5 & 3 & 4 & 6 & 2 \\ 3 & 6 & 1 & 4 & 2 & 5 \\ 1 & 2 & 3 & 4 & 5 & 6 \end{pmatrix}$ Order of 6_3 is 6.

5. a) $\binom{30}{9} = 14\,307\,150$

b) i. $4/52$ ii. $4/5$ iii. $1/5$ iv. $1/365$ v. $364/365$.

6. a) i) $1/\binom{49}{6} = \frac{1}{13\,989\,816}$

ii) For n balls choosing r, $\frac{1}{\binom{n}{r}}$.

b) i) $\frac{\binom{6}{5}\binom{43}{1}}{\binom{49}{6}} = \frac{258}{13\,989\,816}$

ii) Draw r balls from n and match t of them:

$$\frac{\binom{r}{t}\binom{n-r}{r-t}}{\binom{n}{r}}$$

7. 10 stars and 5 bars: $\binom{15}{5} = 3003$.