1. 

\[ R \cap (S \cup T) \text{ or } R \cap (S \cap T)' \text{ or } R \cap (R \cap S \cap T)' \text{ or } R \cap (R \cup S \cup T) \text{ or } (R \cap S') \cup (R \cap T) \text{ or there are probably other ways of writing this I have not listed.} \]

Where \( n(J) = \text{number of people who surf} \) and \( n(S) = \text{number of people who job} \), then \( n(S \text{ or } J) = n(S) + n(J) - n(S \text{ and } J) \), so \( n(S) = n(S \text{ or } J) - n(J) + n(S \text{ and } J) = 600 - 400 + 150 = 350 \). 200 is the number who only surf.

If \( A \cap B = B \), then it must be that \( B \subset A \) so that \( A \cup B = A \).

\( (A \cap B)' = A' \cup B \)

2. 

5 eat only dinner (and no other meal).

10 eat a breakfast and lunch, but not dinner.

10 + 5 = 15 eat breakfast or lunch (but not both), and not dinner.

15 + 25 + 30 + 5 = 75 eat dinner (this was given)

10 + 10 + 15 + 25 + 30 + 5 = 95 eat breakfast or dinner (or both).

10 + 5 + 5 = 20 eat just one meal per day.

10 + 15 + 30 = 55 eat exactly two meals per day.
3. (# ways to order parent 1, parent 2 and the girls)(# ways to order the 3 girls) = 3!·3! = 36

P(40,8); not C(40,8), as the order does matter, since the positions are different.

\[
P(10,7) = \frac{10!}{7!3!} = \frac{10 \cdot 9 \cdot 8 \cdot 7!}{7! \cdot 3 \cdot 2 \cdot 1} = 120; \text{ you could also answer } C(10,7) \cdot 7!
\]

\[
9 \cdot 10 \cdot 10 \cdot 9 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10
\]

(# ways to choose 4 men)(# ways to choose 3 women) = \( C(15,4) \cdot C(15,3) \)

You can think of choosing the seven people by choosing which seven couples would have someone on the committee and then choosing which person from each couple would be chosen (seven times, one for each couple), so the answer would be \( C(15,7) \cdot 2^7 \). Note that the answer \( 30 \cdot 28 \cdot 26 \cdot 24 \cdot 22 \cdot 20 \cdot 18 \) would be the same as \( P(15,7) \cdot 2^7 \), which is not quite correct.

35!

The 3-digit numbers are 100 through 999. That is, a 3-digit number is one that has a 1 – 9 as the first digit, plus a 0 – 9 for the second and third digit. There are two ways to solve this.

Approach 1. There are three ways to have a 3-digit number where exactly two of the digits are the same: The first two digits could be the same with the third different (there are \( 9 \cdot 1 \cdot 9 = 81 \) of these, since once you’ve chosen the first digit, there is only one choice for the second digit), else the first and third digits are the same (\( 9 \cdot 9 \cdot 1 = 81 \) ways), else the second and third digits are the same (\( 9 \cdot 9 \cdot 1 = 81 \) ways). So there is a total of \( 3 \cdot 81 = 243 \) ways.

Approach 2. There are 3 types of 3-digit numbers: those with all 3 digits the same (there are 9 of these), those with exactly 2 digits the same, and those with exactly one digit the same (i.e. those where all 3 digits are different; there are \( 9 \cdot 9 \cdot 8 = 648 \) of these). Since there are 900 3-digit numbers, then there are \( 900 – 900 = 243 \) of the numbers with exactly two digits the same.

\[ 2^{10} = 1024 \]

\[ 3^{10} = 59049 \]

\[ C(10,0) + C(10,1) = 10 + 1 = 11 \]

\[ \text{total # ways to vote} = \# \text{ ways to vote no on } \geq 2 + \# \text{ ways to not vote no on } \geq 2 \]

\[ = \# \text{ ways to vote no on } \geq 2 + \# \text{ ways to vote no on } < 2, \]

So \( \# \text{ ways to vote no on } \geq 2 = \text{total # ways to vote} – \# \text{ ways to vote no on } < 2 \)

\[ = 1024 – 11 = 1013 \]

\[ 2 \cdot 5 \cdot 3 \]

\[ 10^5 \text{ or } \frac{10^5}{5!} \] (the wording was a bit ambiguous about whether orders or not)

\[ 2 \cdot 5 \cdot 3 \cdot 1 \cdot 4 \cdot 2 \text{ or } C(2,12) \cdot C(5,2) \cdot C(3,2) \] (depending on whether order matters)