1. $\boxed{5}$. $6! = 2^4 \cdot 3^2 \cdot 5$, which means $n = \boxed{5}$.

2. $\boxed{18}$. $\lfloor \frac{75}{5} \rfloor + \lfloor \frac{75}{25} \rfloor = 15 + 3 = \boxed{18}$.

3. There are $4 \times 4 \times 3 = 48$ ways to select a 3-digit number. The numbers divisible by 3 are from digit triples of $(0, 2, 4), (0, 4, 8), (2, 4, 6)$, and $(4, 6, 8)$ for a total of 20 selections. The probability is $P = \frac{20}{48} = \boxed{\dfrac{5}{12}}$.

4. $\boxed{2664}$. $1332 = 2^2 \cdot 3^2 \cdot 37$ and $888 = 2^3 \cdot 3 \cdot 37$. $LCM(1332, 888) = 2^3 \cdot 3^2 \cdot 37 = \boxed{2664}$.

5. $\boxed{6}$. $18 = 2 \cdot 3^2$, which has $\boxed{6}$ factors or divisors.

6. $\boxed{10}$. We pick a month with the most factors which is 12. We can then simply list the dates that are relatively prime: 1, 5, 7, 11, 13, 17, 19, 23, 29, and 31 for a total of $\boxed{10}$ dates.

7. $\boxed{8}$. An odd number can be expressed as $2k - 1$. Thus, the four consecutive odd numbers are $2k - 3 + 2k - 1 + 2k + 1 + 2k + 3 = 8k$, which is a multiple of $\boxed{8}$.

8. $\boxed{16}$. For a number divisible by 4, it must end in 4, 12, 24, and 32. For one-digit number, we have 1 (4). For two-digit number, we have 3 (12, 24, 32). For 3-digit number, we have 6 (two each for number ending in 12, 24, and 32). For 4-digit number, we also have 6. So, the total is $1 + 3 + 6 + 6 = \boxed{16}$.

9. $\boxed{192}$. The number $N = p \cdot q^6$ has 14 positive divisors if p and q are prime. The minimize, we have $N = 3 \cdot 2^6 = \boxed{192}$.

10. $\boxed{2}$. $\lfloor \frac{300-100}{88} \rfloor = \boxed{2}$.