Name: Date:

1. (a) $\boxed{2.25}$ (b) $\boxed{0.0\overline{89}}$ (c) $\boxed{\text{-}0.325}$

2. A reciprocal is the fraction flip of a number. The first 10 positive integers are 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10. Their reciprocals are $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}$, and $\frac{1}{10}$. The decimal equivalents of these fractions are $1, 0.5, 0.\overline{3}, 0.25, 0.2, 0.1\overline{6}, 0.\overline{142857}, 0.125, 0.\overline{1}$, and 0.1. So there are $\boxed{4}$ repeating reciprocals.

3. $\dfrac{6!+5!}{5!+4!} = \dfrac{720+120}{120+24} = \dfrac{840}{144} = \dfrac{35}{6} = \boxed{5.8\overline{3}}$

4. $\boxed{7}$

5. $\boxed{\frac{4}{9}}$

6. To find repeating decimal's cooresponding fraction, you find the number of repeating digits and divide by that many 9's like in part b and c. Part d requires algebra.

   (a) $\boxed{\frac{21}{5}}$

   (b) $7.\overline{6} = 7\frac{6}{9} = 7\frac{2}{3} = \boxed{\frac{23}{3}}$

   (c) $-3.\overline{428} = -3\frac{428}{999} = \boxed{-\frac{3425}{999}}$

   (d) Let x be the fraction that corresponds to $0.1\overline{27}$. So we have $x = 0.1\overline{27}$. Now multiply both sides by 100 (we choose 100 because there are 2 repeating digits, so we multiply by the multiple of 10 with 2 zeros). So we have $100x = 12.7\overline{27}$. Now we consider the equations side by side:

$$\begin{aligned} 100x &= 12.7272727\ldots \\ x &= 0.1272727\ldots \end{aligned}$$

   Now subtract the bottom equation from the top equation, and we get $100x - x = 99x$ on the left, and $12.72727... - 0.12727... = 12.7 - 0.1 = 12.6$. So we have $99x = 12.6 = 12\frac{6}{10} = 12\frac{3}{5} = \frac{63}{5}$. Now we solve for x by dividing both sides by 99: $x = \frac{63}{5} \times \frac{1}{99} = \frac{63}{495} = \boxed{\frac{7}{55}}$

7. Write $0.\overline{9}$ as a fraction: $0.\overline{9} = \frac{9}{9} = 1$. So there is $\boxed{\text{no difference}}$ between the 1 and $0.\overline{9}$.

8. $10^1 = 10$ has 1 zero, $10^2 = 100$ has 2 zeros, $10^3 = 1000$ has 3 zeros. Notice the pattern: 10 raised to the x power has x zeros. So 10^{30} has 30 zeros. The total digits of the decimal expansion (or written out without exponents) is 30 zeros plus the 1 at the beginning. So $\boxed{31}$ digits.

9. We know $2^{10} = 1024$. So $2^{30} = (2^{10})^3 = (1024)^3 \approx (1000)^3 = (10^3)^3 = 10^9$. We know from the previous problem that this number has $\boxed{10}$ digits.

10. Notice $10^{30} = 2^{30} \times 5^{30}$. Since 10^{30} has 31 digits and 2^{30} has 10 digits, 5^{30} has $31 - 10 = \boxed{21}$ digits.