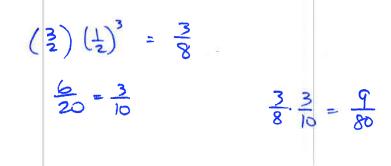Instructions: Show all work. Answer each question as completely as possible. Use exact values. For counting problems you may use scientific notation (with three significant figures) for any numbers larger than a million.

1. List the events in the sample space for 4 coin flips.

HHHH   HHHT   HHTH   HTHH   THHH   HHTT   HTHT

HTTH   THTH   TTHH   HTTT   THTT   TTHT   TTTH

TTTT   THHT

2. What is the probability that you will flip three coins and obtain two heads, and roll a 20-sided die and obtain a number divisible by three?

$$\left(\frac{3}{2}\right)\left(\frac{1}{2}\right)^3 = \frac{3}{8}$$

$$\frac{6}{20} = \frac{3}{10}$$

$$\frac{3}{8} \cdot \frac{3}{10} = \frac{9}{80}$$

3. If the probability of finding a random book is a history book in a particular library is 22%, and the probability of finding a random book is a math book in a particular library is 8%. Suppose that the probability that a random book is both a history book and a math book (i.e. a history of math book) is 0.5%. What is the probability of finding either a history book or a math book if the book is selected at random?

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$.22 + .08 - .005 = .295$$

$$29.5\%$$

4. Find the expected value of a dice game if you earn $4 if you get a six, $2 if you get a three, and lose $1.50 if you get any other result. Is the game fair?

$$4\left(\frac{1}{6}\right) + 2\left(\frac{1}{6}\right) - 1.50\left(\frac{4}{6}\right) = 0$$

Yes, the game is fair