Probably going to pass this test: _Jason Hahn_ (signature)
Period: __D__

96/100

Multiple Choice (4 points each):

1. 6 points are randomly drawn onto a circle. How many unique triangles can be formed using the points as vertices?
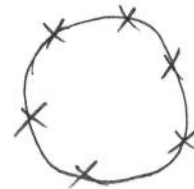
a) $_6P_3$ b) $_6C_3$ ✓   c) 6!   d) 3!   e) 3^6

2. In 2011, China's population was 51.9% male and 48.1% female, an imbalance caused in part by China's one-child policy (source: United Nations Development Programme). If 12 people are randomly selected from China's population, find the probability that exactly 5 of them are male.

a) $(.519)^5(.481)^7$ b) $(.519)^7(.481)^5$ c) $1-(.519)^7(.481)^5$

d) $\binom{12}{5}(.519)^5(.481)^7$ ✓   e) $(.519)^5$

3. I have 35 desks in the room. How many ways can I do a seating chart for a class of 20 students?

a) $\binom{35}{20}$ b) $_{35}P_{20}$ ✓   c) 20!   d) 35!   e) $\dfrac{35!}{20!}$

4. 2 cards are drawn without replacement from a standard deck of cards. Find the probability that the second card is a face card (Jack, Queen, or King), given that the first card is not a face card.

$\dfrac{P(A \cap B)}{P(B)}$

a) $\dfrac{33}{153}$ b) $\dfrac{11}{51}$ c) $\dfrac{12}{51}$ ✓   d) $\dfrac{40}{51}$ e) $\dfrac{10}{13}$

First card is not face card: $\dfrac{10}{13}$ Second card is face card, first is not: $\dfrac{40}{221}$

5. Kenny is eating jellybeans. He has a handful left: 6 strawberry, 4 lime, and 3 orange. If he eats the jellybeans 1 at a time, how many unique flavor experiences can he create for himself?

a) $\binom{6}{1}\binom{4}{1}\binom{3}{1}$ b) 6!4!3!   c) $\dfrac{13!}{6!4!3!}$ ✓   d) 13!   e) $\binom{13}{6}\binom{13}{4}\binom{13}{3}$

Multiple Choice (continued)

6. How many ways can I arrange 9 keys on a key ring?

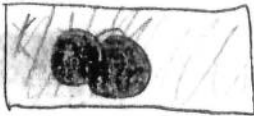a) $9!$ b) $\dfrac{9!}{2!}$ c) $8!$ (d) $\dfrac{8!}{2!}$ ✓   e) $\dfrac{7!}{2!}$

7. Victoria is playing a game with a single 20-sided die. If she rolls an even number, she wins $5, but if she rolls an odd number, she only wins $1. It costs her $4 to play each time. What is the expected value of the game?

a) $3   b) -$3   c) $1   (d) -$1 ✓   e) $5

$$\frac{10\cdot5+10\cdot1-4\cdot20}{20} = -1$$

8. $(A \cup B)' =$

a) $(A' \cup B')$ (b) $(A' \cap B')$ c) $(A \cap B)$ d) $(A \cap B)'$ e) None of these

✓

Free Response. For each problem, show your work (what you typed into your calculator), along with a simplified, numerical answer (decimal or a simplified fraction). For very small/large numbers, give your answer in scientific notation with 3 decimal places.
**Correct answers with no work shown will receive no credit.

9. Bank ATM PIN numbers consist of 4 digits, 0-9.

a) What is the probability that you can guess someone's PIN number in one try? (4 points)

$$10\cdot10\cdot10\cdot10 = 10000 \quad \text{ex.} (4296)$$

$$\boxed{\dfrac{1}{10000}} \quad ✓$$

b) Rob uses the ATM to withdraw money, but since he's eating fried chicken at the time, he leave greasy fingerprints on the numbers 3, 4, and 7. Then Bob (who loves Rob dearly) goes to use the ATM next, sees the fingerprints, and realizes that Rob's PIN number consists of some combination of those digits. What is the probability that Bob can guess Rob's PIN number in one try? (4 points)

$$\frac{3}{3}\frac{4}{4}\frac{7}{?}\frac{?}{7} \qquad ? = 3, 4, \text{ or } 7$$

$$24\cdot3 = 72$$

$$\boxed{72 \div 2} \qquad \dfrac{1}{36}$$

$4P_3$ ways,

24 ways

$$\frac{3}{?}\frac{?}{3}\frac{4}{4}\frac{7}{7}$$

10. Carissa is playing a card game. She is being dealt 4 cards out of a standard deck. Find the following (4 pts each):

a) P(3 of a kind)

$$\frac{13 \cdot \binom{4}{3} \cdot \binom{48}{1}}{\binom{52}{4}} = \boxed{\frac{192}{20825}}$$ ✓

b) P(2 Kings and 2 Queens)

$$\frac{\binom{4}{2} \cdot \binom{4}{2}}{\binom{52}{4}} = \boxed{\frac{36}{270725}}$$ ✓

c) P(all 4 cards are the same suit)

$$\frac{4 \cdot \binom{13}{4}}{\binom{52}{4}} = \boxed{\frac{44}{4165}}$$ ✓

d) P(no face cards)
(face cards are Jacks, Queens, Kings)

$$\frac{\binom{40}{4}}{\binom{52}{4}} = \boxed{\frac{1406}{4165}}$$ ✓

e) If Carissa gets 3 of a kind, she wins $200. If she gets no face cards, she wins $10. If neither of these events happen, she wins nothing. Given that the game costs her $5 to play each time, find the expected value of the game.

$$200 \cdot \frac{192}{20825} + 10 \cdot \frac{1406}{4165} - 5 = \boxed{\$0.22}$$ ✓

11. A recent Gunn survey (albeit with questionable polling techniques) of 100 students returned the following results:
- 37 of them enjoy English class (E)
- 82 of them enjoy math class (M)
- 5 of them enjoy neither
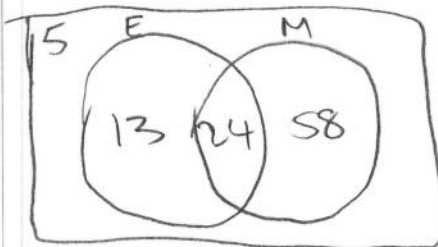
If a random student is selected out of the group, find the following (3 pts each):

a) $P(E \cap M)$

$$\frac{24}{100} = \boxed{\frac{6}{25}}$$ ✓

b) $P(E \cup M)$

$$\frac{95}{100} = \boxed{\frac{19}{20}}$$ ✓

c) $P(E \cap M')$

$$\boxed{\frac{13}{100}}$$ ✓

d) $P(E|M)$ ← $\frac{P(E \cap M)}{P(M)}$

$$\frac{24}{82} = \boxed{\frac{12}{41}}$$ ✓

12. There are 2 jars: A and B. A contains 5 blue marbles and 3 red marbles, and B contains 3 blue marbles and 2 red marbles. A random marble is drawn from Jar A, and placed into Jar B. Then a random marble is drawn from Jar B. Find the following (4 points each):

   a) P(both marbles are red)

$$\frac{3}{8} \cdot \frac{1}{2} = \boxed{\frac{3}{16}} \quad \checkmark$$

   b) P(2nd marble is red)

$$\frac{5}{8} \cdot \frac{1}{3} + \frac{3}{8} \cdot \frac{1}{2} = \boxed{\frac{19}{48}} \quad \checkmark$$

   c) P(2nd marble is red | 1st marble is blue)

$$\frac{\frac{5}{8} \cdot \frac{1}{3}}{\frac{5}{8}} = \boxed{\frac{1}{3}} \quad \checkmark$$

   d) P(1st marble is red | 2nd marble is blue)

$$\frac{\frac{3}{8} \cdot \frac{1}{2}}{\frac{5}{8} \cdot \frac{2}{3} + \frac{3}{8} \cdot \frac{1}{2}} = \boxed{\frac{9}{29}} \quad \checkmark$$

13. Ash Ketchum is in the middle of a fierce Pokémon duel! He's down to 3 Pokéballs in his backpack. He knows that 1 of the balls will summon Squirtle, and the other 2 will summon fierce dragon creatures, but of course, he forgot which ball is which. Squirtle, being friendly, has only a 30% chance of winning the duel, and each dragon has an 80% chance of winning. Ash reaches into his bag and randomly pulls out a Pokéball...

Find the following (4 pts each):

   a) P(Ash wins)

$$\frac{1}{3} \cdot \frac{3}{10} + \frac{2}{3} \cdot \frac{8}{10} = \boxed{\frac{19}{30}} \quad \checkmark$$

   b) P(Squirtle is summoned | Ash wins)

$$\frac{\frac{1}{3} \cdot \frac{3}{10}}{\frac{19}{30}} = \boxed{\frac{3}{19}} \quad \checkmark$$

   c) P(Squirtle is summoned ∩ Ash loses)

$$\frac{1}{3} \cdot \frac{7}{10} = \boxed{\frac{7}{30}} \quad \checkmark$$