Geometry · Unit 8 Worksheet

Conditional Probability

Name: _____ Date: _____

Conditional probability is P(A given B) = P(A and B) / P(B). Independence means P(A and B) = P(A)·P(B). Tree diagrams, Venn diagrams, and two-way tables help you see what's going on — use them.

Part A · Sample Spaces and Basic Probability

1. A spinner has 8 equal sectors: 3 red, 3 blue, 2 yellow. A six-sided die is also rolled. The experiment is one spin and one roll.

How many outcomes are in the sample space? _____

P(red and 6) = _____

P(yellow and even) = _____

Sketch a TREE diagram for the spinner outcomes (red, blue, yellow), then the die outcomes (1-6).

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2. From a standard 52-card deck, one card is drawn.

a. P(heart) = _____

b. P(face card) = _____ (J, Q, K of any suit)

c. P(heart AND face card) = _____

d. Using the Addition Rule: P(heart OR face card) = P(heart) + P(face card) - P(heart AND face card) = _____

Part B · Two-Way Tables and Conditional Probability

3. A survey of 200 students asked about preferred subject and grade level.

	Math	English	Science	Total
9th	30	20	25	75
10th	25	30	20	75

11th-12th	15	20	15	50
Total	70	70	60	200

P(prefers Math) = _____

P(in 9th grade) = _____

P(prefers Math AND in 9th grade) = _____

P(prefers Math GIVEN 9th grade) = P(Math AND 9th) / P(9th) = _____

P(in 9th grade GIVEN prefers Math) = _____

Part C · Independent Events

4. Two events A and B are INDEPENDENT if and only if P(A and B) = P(A) · P(B), or equivalently, P(A | B) = P(A).

In Problem 3, is 'prefers Math' independent of 'in 9th grade'? Compute both and compare:

What would have to be true of the table for these to be perfectly independent?

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5. A coin is flipped 3 times.

Are the flips independent? Yes / No. Why?

P(all 3 heads) = _____

P(at least 1 head) = 1 - P(no heads) = 1 - _____ = _____

Part D · Multiplication Rule and Conditional

6. The Multiplication Rule says: P(A and B) = P(A | B) · P(B), OR equivalently P(B | A) · P(A).

A bag has 5 red and 7 blue marbles. Two are drawn WITHOUT replacement.

a. P(first is red) = _____

b. P(second is red | first is red) = _____

c. P(both red) = (a) · (b) = _____

Why does the conditional probability matter here? Why aren't the draws independent?

Part E · Venn Diagrams

7. In a class of 30 students, 18 play sports, 14 play music, and 8 play both.

Sketch a Venn diagram with circles for 'plays sports' and 'plays music'.

How many play sports but NOT music? _____

How many play NEITHER? _____

P(plays music | plays sports) = _____

Part F · Error Analysis

8. Andre says: "I rolled a die three times and got three 6s. The next roll has a LOWER probability of being a 6, because four 6s in a row is really unlikely." Is Andre correct?

Yes / No:

What's the actual probability of a 6 on the next roll? Why?

What's the name of this fallacy?

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9. Mai writes: "P(rain | umbrella) means: the probability of rain, given that someone has an umbrella." Diego writes: "P(umbrella | rain) means: the probability of rain, given an umbrella." Who is correct?

Correct: _____

Explain the notation P(A | B) precisely:

Part G · Synthesis / Modeling

10. A test for a disease has 95 percent sensitivity (P(positive | disease) = 0.95) and 90 percent specificity (P(negative | no disease) = 0.90). In the population, 2 percent of people have the disease.

If a random person tests positive, what's the probability they actually have the disease? (Use a 1000-person table.)

Why might this probability be SURPRISINGLY low?

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11. OPEN: Design your own probability experiment. State a question, identify the sample space, decide whether the events you're asking about are independent or not, and compute the probability you're after.

Experiment:

Sample space and events:

Computation: