Ski Time!

You have been hired to help remodel a ski resort that is undergoing renovations. In particular, you have been contracted to help with the interior design of the lodge so that the patrons of the ski slopes feel comfortable, cozy, and carefree. As you work to solve the problems below, you find you are using your skills in writing and evaluating expressions with exponents.

Worksheet 1: Exponents in Algebraic Expressions

Work the Math

Directions: Record your responses on a separate sheet of paper and show your work.

1. The main room of the lodge will be a large square of 12 × 12 yards with a few square tables at which to sip hot chocolate and warm up after skiing.

a. Write an expression with exponents that represents the area of the main room.

b. Write an expression that describes how much floor space is left after you place six square tables in the main room.

c. You could choose tabletops that are 1.75 × 1.75 yards or 2.125 × 2.125 yards. For each size of table, find how much floor space would be left after placing the square tables in the main room.

2. You are tasked with buying plates and mugs for the lodge’s café. You want to make sure patrons will have a comfortable amount of room on the tables for your selections. Note: The formula for the area of a circle is \( \pi r^2 \), where \( r \) is the radius of the circle. Use 3.14 for \( \pi \).

About how much table space would each of the following occupy?

a. A plate with an 11-inch diameter
b. A plate with a 10-inch diameter
c. A mug with a 4-inch diameter
d. A mug with a 5-inch diameter

3. The ski resort is adding more chairlifts to get skiers to the top of the slopes efficiently. To operate the chairlifts, the lodge will require that 12 additional employees work during each morning shift and nine additional employees work during each afternoon shift. Each employee will earn $15 per hour.

a. Write an expression that describes the amount of additional money the ski resort will spend on employee wages per day if the slopes are open for \( m \) morning hours and \( e \) evening hours.

b. The ski slopes are open for five morning hours and four evening hours each day. How much additional money will the resort spend on employee wages per day?

4. The first week that the ski resort is reopened, the lodge café collects $9,000 in revenue. For each subsequent week over the next few weeks, the revenue triples.

Write an expression with exponents that describes how much revenue the café collects during:

a. The second week
b. The third week
c. The fourth week
d. The \( n \)th week
e. By the fifth week, the café manager hopes to be collecting at least $600,000 in revenue each week. Is the café manager happy?