

## ACT Activities

Examples directly align to Agriculture, Food, and Natural Resources career cluster standards

### Career Cluster: Agriculture, Food, and Natural Resources *Mathematics in Landscaping and Turf Science – Addressing Standard 20*

You have a customer that wants to include some handmade colored 12 inch tile for a new gazebo sitting gondola area. These tiles were handmade by her late aunt in the following colors, dark blue, red, black, dark green. She has three times as many black tiles as red tiles, twice as many blue tiles as dark green tiles, and the same number of black and dark green tiles.

#### Question 1)

If there are only 10 red tiles, how many tiles of each color must you use?

	Black Tile	Blue Tile	Dark Green Tile
A.	3	2	3
B.	3	2	30
C.	30	2	30
D.	10	60	30
E.	30	60	30

**Solution: E.** Use process of elimination aggressively. Since the customer only had 10 red tiles, you use three times  $10 = 30$  black tiles, eliminating choices A, B, and D. Thus, you would use 30 dark green and twice  $30 = 60$  blue tiles. Choice C list 2 rather than  $2 \times 30$  for the number of blue tiles.

#### Question 2)

The gazebo concrete pad is 14 feet long by 12 feet wide. After determining the number of each colored handmade tile, in the problem above, will you need to purchase additional 12 inch tile? If so, how many tile will you need to purchase?

- A. 0
- B. 18
- C. 30
- D. 38
- E. 60

**Solution: D.** Calculate the square footage of the gazebo  $14 \times 12 = 168 \text{ ft}^2$  minus the sum of handmade colored tile, black, blue, dark green and red,  $30+60+30+10 = 130$ . Since the size of the standard 12 inch tile is equal to  $1 \text{ ft}^2$ , simply subtract the number of the colored handmade tile from the square footage of the gazebo concrete pad,  $168-130 = 38$ ,

**Career Cluster: Agriculture, Food, and Natural Resources**  
**Mathematics in Principles of Agribusiness – Addressing Standard 7**

Sales for a business were three million dollars more the second year than the first, and sales for the third year were double the sales for the second year. If sales for the third year were 38 million dollars, what were sales, in millions of dollars, for the first year?

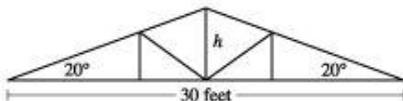
- A. 16
- B. 17.5
- C. 20.5
- D. 22
- E. 35

**Solution: A.** If  $x =$  sales for the first year, then  $x + 3 =$  sales for the second year. Since sales for the third year were double the sales for the second year, sales for the third year  $= 2(x + 3)$ . Sales for the third year were 38, so  $2(x + 3) = 38$ . To solve this equation, you could first divide each side by 2 to get  $x + 3 = 19$ . Then, by subtracting 3 from both sides,  $x = 16$ .

Source: The ACT: Sample Math Questions: set 1. [http://www.actstudent.org/sampletest/math/math\\_01.html](http://www.actstudent.org/sampletest/math/math_01.html)  
Visited Feb. 25, 2016

**Career Cluster: Agriculture, Food, and Natural Resources**  
**Mathematics in Principles of Agricultural Mechanics – Addressing Standard 12**

Which of the following expressions is the closest approximation to the height  $h$ , in feet, of the roof truss shown below?



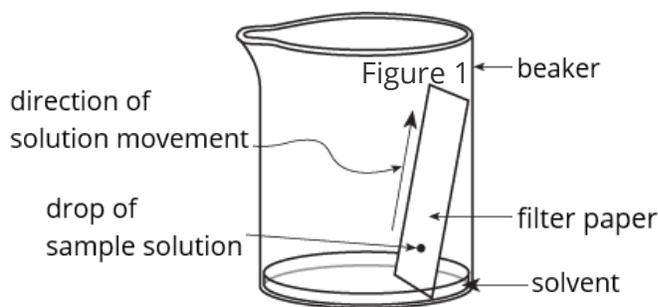
- A.  $15 \tan 20^\circ$
- B.  $15 \sin 20^\circ$
- C.  $30 \tan 20^\circ$
- D.  $30 \sin 20^\circ$

**Solution: A.** This is the correct response.  $YZ = \frac{1}{2}XZ = \frac{1}{2}(30) = 15$ . So,  $\tan 20^\circ = \frac{h}{YZ} = \frac{h}{15}$ . Then,  $h = 15 \tan 20^\circ$ .

Source: The ACT: Sample Math Questions: Set 4. [http://www.actstudent.org/sampletest/math/math\\_04.html](http://www.actstudent.org/sampletest/math/math_04.html)  
Visited Feb. 15, 2016

**Career Cluster: Agriculture, Food, and Natural Resources**  
**Science in Applied Environmental Science – Addressing Standard 16**

*Paper chromatography* can be used to identify metal ions in runoff and wastewater. A drop of the sample solution is placed on filter paper. The bottom of the paper is set in a solvent that travels up the paper (see Figure 1).



The solvent carries the ions up the paper. Some ions move faster, and therefore farther than others, resulting in a separation as they move up the paper. The paper is dried, then stained, causing the ions to appear as colored spots.  $R_f$  values are calculated for each spot:

$$R_f = \frac{\text{total linear distance traveled by ion}}{\text{total linear distance traveled by solvent}}$$

Table 1 shows  $R_f$  values for 5 ions.

Ion	Molar mass (g/mole)	Distance traveled (cm)	$R_f$	Spot color
Nickel ( $\text{Ni}^{2+}$ )	58.7	0.8	0.08	pink
Cobalt ( $\text{Co}^{2+}$ )	58.9	3.5	0.35	brown-black
Copper ( $\text{Cu}^{2+}$ )	63.5	6.0	0.60	blue
Cadmium ( $\text{Cd}^{2+}$ )	112.4	7.8	0.78	yellow
Mercury ( $\text{Hg}^{2+}$ )	200.6	9.5	0.95	brown-black

Table 1

Table 1 adapted from Thomas McCullough, CSC, and Marissa Curlee, "Qualitative Analysis of Cations Using Paper Chromatography." ©1993 by the American Chemical Society

Based on the information in Table1, when using the paper chromatography method to identify a metal

ion, one should know the:

- A. spot color for the ion only.
- B. distance the solvent traveled only.
- C. R<sub>f</sub> value and spot color for the ion only.
- D. distance the solvent traveled and spot color of the ion only.

**Solution: C is the best answer.** Spot color can be used to restrict the range of options used to identify a metal ion. However, some metals, such as cobalt and mercury, have the same spot color (brown-black). To determine the identity of a brown-black spot, one also needs to know the R<sub>f</sub> of the spot.

Source: The ACT: Sample Science Questions: Passage 5. [http://www.actstudent.org/sampletest/science/sci\\_05.html](http://www.actstudent.org/sampletest/science/sci_05.html), Visited Feb. 25, 2016

**Career Cluster: Agriculture, Food, and Natural Resources**  
**Mathematics in Principles of Food Production – Addressing Standard 8**

Soils fertility is based on mineral and organic material content. The ideal concentration of various minerals are given in parts per million (ppm) in Table 1. If the level of different minerals of a soil are all similar, the soil is said to be well defined. If the levels of different minerals in a soil vary widely, the soil is said to be poorly defined.

Minerals	Ideal concentration (ppm)
Nitrogen	22
Phosphorus	14
Potassium	129
Chloride	12
Sulfur	88
Iron	6.9
Manganese	2.7

Table 1

Soil samples were taken at four different farms for testing. The samples were tested for the concentration of minerals present in each sample. The results are listed in Table 2.

Mineral	Concentration of minerals (% or ideal concentration)			
	Farm 1	Farm 2	Farm 3	Farm 4
Nitrogen	91	112	160	78

Phosphorus	75	15	235	94
Chloride	124	106	64	87
Sulfur	290	87	189	102
Iron	74	26	73	91
Manganese	77	45	89	97

Table 2

Which farm would likely be considered to have the most well defined soil, based on the information above?

- A. Farm 1
- B. Farm 2
- C. Farm 3
- D. Farm 4

**Solution: D.** At the end of the first paragraph, we find that a well-defined soil has similar levels of minerals. Thus you are looking for the farm with similar percentages in Table 2. The soil of Farm 4, with all values within 24 percent of each other, is the most well defined soil.

Source: Hendrix, M. (2015). *1,460 ACT practice questions* (Fourth ed.). NY: Penguin Random House. Science Reasoning Test page 406