Answers to Math Quiz

by David Wehner

Last month, the **Bull Sheet** presented a math quiz for you to try. Here are the explanations of how the problems are worked and the answers to the problems. Step-by-step solutions to these types of problems (numbers 1-5) are illustrated in the GCSAA booklet "The Mathematics of Turfgrass Management." Solutions to the spray calibration problems are illustrated in the pesticide training manuals for the State of Illinois. This quiz was worth 50 points. Give yourself partial credit on a problem if you set the problem up right, but there was a math mistake. Also give yourself partial credit if the problem involved two calculations, and you got one of the calculations correct. Point values for each part of the problem are indicated within parenthesis e.g. (3) means that the calculation was worth three points. If you scored 45 or higher, you got an A; 40-44 = B; 35-39 = C; 30-34 = D; below 30 = F. The abbreviation M = 1000 square feet, A = acres, lb = pounds, oz = ounces, gal = gallons, and sq ft = square feet.

1. Calculate how much N is needed (3), then calculate the amount of fertilizer to buy (2):

$$2.5\ A \times \frac{43.56\ M}{A} \times \frac{0.75\ lb\ N}{M} = 81.7\ lb\ N$$

$$81.7\ lb\ N \times \frac{1\ lb\ fert}{0.16\ lb\ N} = 510\ lb\ fertilizer\ needed$$

2. Calculate how much of the SCU is applied per M (3), then calculate how much elemental K is applied (4). K_2O is 83% elemental K.

$$1.5\ lb\ N \times \frac{1\ lb\ of\ fert}{0.22\ lb\ N} = 6.8\ lb\ of\ fertilizer\ per\ M$$

$$6.8\ lb\ fert \times \frac{0.1\ lb\ K_2O}{lb\ fert} \times \frac{0.83\ lb\ K}{lb\ K_2O} = 0.56\ lb\ elemental\ K\ per\ M$$

3. Calculate how many acres are sprayed with each tank (3), then calculate how much herbicide is needed (3).

$$200\ gal \times \frac{1A}{35\ gal} = 5.71\ per\ tank = 5.71\ lb\ of\ 2,4\text{-}D\ needed\ per\ tank$$

$$5.71\ lb\ 2,4\text{-}D \times \frac{1gal\ herbicide}{4\ lb\ 2,4\text{-}D} = 1.43\ gal\ of\ 2,4\text{-}D\ added\ to\ tank$$

4. Calculate how many acre inches of water are available (4), subtract out water used on the greens and tees (2), then calculate how much is available for fairways (4).

$$\frac{275{,}000\ cubic\ ft \times 7.48\ gal\ per\ cubic\ ft}{27{,}154\ gal\ per\ acre\ inch} = 75.75\ acre\ inches\ available$$

5 A greens & tees x 4 acre inches (June 1-28) = 20 acre inches on greens & tees

55.75 acre inches left for fairways

$$\frac{55.75\ acre\ inches}{20\ A} = 2.78\ inches\ for\ fairways\ or\ 0.69\ per\ wk$$

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(Math Quiz continued)

5. Determine how many pounds of active ingredient (a.i.) are in each formulation (4), then calculate the cost of each pound for the formulation (4).

4A formulation: 5 gal x 4 lb a.i. per gal = 20 lb a.i.

$\frac{\$540.75}{20 \text{ lb. a.i.}} = \$27.03$ per lb a.i.

50 WP formulation: 12 lb x $\frac{0.5 \text{ lb a.i.}}{\text{lb. formulation}} = 6$ lb a.i.

$\frac{\$192.50}{6 \text{ lb. a.i.}} = \$32.08$ per lb a.i. (Note: WP is in water soluble packets)

6. To use the formula provided, you must calculate the GPM (gal per minute) of the nozzle (3), then calculate the GPA (gal per A) (3)

8 oz from nozzle in 10 seconds means 48 oz per minute

$\frac{48 \text{ oz}}{\text{minute}} \times \frac{1 \text{ gal}}{128 \text{ oz}} = 0.375$ GPM

$\frac{0.375 \text{ GPM} \times 5940}{3 \text{ MPH} \times 20 \text{ inch spacing}} = 37.125$ GPA

Therefore, adjust pressure down.

7. Determine how many square feet were sprayed in test run (3), calculate how many square feet would be covered per tank load (2), then calculate how much Embark in put in tank (3).

100 ft. x $\frac{10 \text{ inches}}{12 \text{ inches per foot}} = 83.3$ sq ft sprayed with 16 oz spray

$\frac{83.3 \text{ sq ft} \times 128 \text{ oz per gal} \times 2 \text{ gal per tank}}{16 \text{ oz spray}} = 1333$ sq ft. per tank load

1333 sq ft per tank x $\frac{4 \text{ ounces Embark}}{1000 \text{ sq ft}} = 5.33$ ounces of Embark per tank

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A video, "Calibrating Golf Course Boom Sprayers" has been developed by the University of Illinois Agricultural Engineering Department. Rhone-Poulenc Turf Division supported this project with funding. The video can be used in training pesticide applicators in the proper use of powered-boom sprayers. Nozzle selection, calibration, electronics, PPE and safety are topics included in this 26 minute presentation.

Anyone interested in receiving a copy could contact Robert Wolf, 217/333-9418 or fax 217/244-0323.