2011 Aquatic Weed Control Math Prep

Workbook Vol 3

By Ken Gioeli
Extension Agent III / Natural Resource

Preface

The workbook is designed for use by agricultural pesticide applicators intending to complete the Aquatic Weed Control restricted-use pesticide license exam under the provisions of the Florida Pesticide Law (Chapter 487 Florida Statutes) and its rules (Chapters 5E-2 and 5E-9 of the Florida Administrative Code). Any herbicides discussed in this workbook are solely for educational purposes and does not imply endorsement of the product.

About the Author

Ken Gioeli is the Natural Resources Extension Agent for St Lucie County. He conducts educational campaigns designed to teach professional land managers as well as general homeowners how to adopt practices and innovative technologies that will result in improved natural resource management.

Aquatic Weed Control Math Workbook

Section 1: Order of Operation

Arithmetic Review

Arithmetic problems must be calculated according to a specific order of operations. The order of operations are as follows:

Parentheses
Exponents
Multiplication / Division
Addition / Subtraction

Calculations within parentheses must be conducted first. Exponents are then calculated followed by multiplication and division. Addition and subtraction is conducted last.

1. Directions: Complete each math problem below using the correct order of operations. Show your work and be prepared to share your answer.

a. $3 \times 4 + 2 =$

b. $15 / 3 =$

c. $20 / 4 + 6 =$

d. $4^2 =$

e. $3^2 + 5 =$

f. $4 \times 2^2 + 3 =$

g. $(4 \times 2)^2 + 3 =$

h. 25% of 75 =

Section 2: Area & Volume Calculations

2. Use the following example to help you calculate area.

Formula

$d=1/2\ r$

Area of a circle: πr^2

[π=3.14] [r (radius) = ½ diameter]

Example: Determine the surface area (in acres) of a circular lake that measures 50 feet across.

d = 50 ft

r = ½ d

r = 25 ft

Area = $\pi\ r^2$

Area = $(3.14)\ (25^2)$

Area = (3.14) (625)

Area = 1962.5 ft^2

$$\text{Area} = \frac{1962.5}{43560}$$

Area = .05 Acres

a. Determine the surface area (in acres) of a circular lake that measures 100 feet across.

b. Determine the surface area (in acres) of a circular lake that measures 2 miles across.

3. Use the following formula to calculate acre-feet.

Formula

Acre-Feet = Surface Acres x Average Depth (ft)

Example: Determine how many acre-feet are in a rectangular pond that has an average depth of 6 ft, is 500 feet wide, and is 1500 ft long.

$$\frac{(6)(500)(1500)}{43560}$$

103 Acre Feet

a. Determine how many acre-feet are in a rectangular pond that has an average depth of 7.5 ft, is 600 feet wide, and is 1200 ft long.

b. Determine how many acre-feet are in a rectangular pond that has an average depth of 6 ft, is 750 feet wide, and is 2000 ft long.

c. Determine how many acre-feet are in a rectangular pond that has an average depth of 5.5 ft, is 625 feet wide, and is 1425 ft long.

4. Determine the quantity of spray mix needed.

Example: Determine the total gallons of spray mix needed to treat 1 mile of canal bank when the treatment swath is 20 feet per side and the application equipment has been calibrated to apply 60 gallons of spray mix per treated acre.

1 mile = 5280 ft

Area = Length x Width
Area = (5280 x 20) = 105600 per side
Area in Acreage = 105600 ÷ 43560 = 4.8 Acres

60 gal / acre x 2.42 acres = 145 gallons

a. Determine the total gallons of spray mix needed to treat 2 miles of canal bank when the treatment swath is25 feet per side and the application equipment has been calibrated to apply 65 gallons of spray mix per treated acre.

b. Determine the total gallons of spray mix needed to treat .5 miles of canal bank when the treatment swath is 20 feet per side and the application equipment has been calibrated to apply 60 gallons of spray mix per treated acre.

c. Determine the total gallons of spray mix needed to treat 2000 ft of canal bank when the treatment swath is 25 feet per side and the application equipment has been calibrated to apply 55 gallons of spray mix per treated acre.

5. Determine how many gallons of surfactant are needed.

Example: Determine the number of gallons of surfactant needed in a 200-gallon spray tank in order to have a 1.5% concentration of surfactant in a tank full of spray mix.

1.5% is the same as .015 in decimal format when conducting calculations

200 x .015 = 3 gallons of surfactant

a. Determine the number of gallons of surfactant needed in a 250-gallon spray tank in order to have a 1.5% concentration of surfactant in a tank full of spray mix.

b. Determine the number of gallons of surfactant needed in a 200-gallon spray tank in order to have a 2% concentration of surfactant in a tank full of spray mix.

c. Determine the number of gallons of surfactant needed in a 300-gallon spray tank in order to have a 3% concentration of surfactant in a tank full of spray mix.

6. Determine the pump output rate.

Example: Determine the output rate (in gallons per minute) of a pump that delivers exactly 20 gallons during a 5 minute trial period.

$20 \div 5 = 4$ gallons per minute

a. Determine the output rate (in gallons per minute) of a pump that delivers exactly 15 gallons during a 3 minute trial period.

b. Determine the output rate (in gallons per minute) of a pump that delivers exactly 18 gallons during a 6 minute trial period.

c. Determine the output rate (in gallons per minute) of a pump that delivers exactly 20 gallons during a 2 minute 30 second trial period.

7. Determine the spray volume rate.

Example: Determine the spray volume rate (in gallons per acre) being delivered by a handgun that discharges 4.5 gallons of spray per minute as it treats a swath 15 feet wide. The handgun is being operated from a truck traveling along the canal bank at a speed of 135 feet per minute

Determine Acreage
135 x 15 = 2025 ft sq
2025 / 43560 = .0464876 Acres

Determine gallons per acre

$$\frac{4.5 \text{ gal}}{.0464876 \text{ acres}} = \frac{x \text{ gal}}{1 \text{ acre}}$$

x = 96.8 gal

a. Determine the spray volume rate (in gallons per acre) being delivered by a handgun that discharges 2.5 gallons of spray per minute as it treats a swath 15 feet wide. The handgun is being operated from a truck traveling along the canal bank at a speed of 135 feet per minute.

b. Determine the spray volume rate (in gallons per acre) being delivered by a handgun that discharges 3.5 gallons of spray per minute as it treats a swath 10 feet wide. The handgun is being operated from a truck traveling along the canal bank at a speed of 135 feet per minute.

c. Determine the spray volume rate (in gallons per acre) being delivered by a handgun that discharges 2.5 gallons of spray per minute as it treats a swath 15 feet wide. The handgun is being operated from a truck traveling along the canal bank at a speed of 125 feet per minute.

8. Determine the number of acres the sprayer-equipped boat can treat per tank.

Example: A sprayer-equipped boat fitted with a 150 gallon spray tank is configured to apply 40 gallons per acres. How many acres can the sprayer-equipped boat be expected to treat per tank full of spray?

$$150 \div 40 = 3.75 \text{ acres}$$

a. A sprayer-equipped boat fitted with a 200 gallon spray tank is configured to apply 30 gallons per acres. How many acres can the sprayer-equipped boat be expected to treat per tank full of spray?

b. A sprayer-equipped boat fitted with a 80 gallon spray tank is configured to apply 25 gallons per acres. How many acres can the sprayer-equipped boat be expected to treat per tank full of spray?

c. A sprayer-equipped boat fitted with a 90 gallon spray tank is configured to apply 20 gallons per acres. How many acres can the sprayer-equipped boat be expected to treat per tank full of spray?

9. Determine the pounds of pellets the spreader must broadcast per minute.

Example: A boat-mounted centrifugal spreader needs to apply a 15% palletized herbicide at a rate of 100 pounds of pellets per acre. Testing reveals the boat treats 0.3 acres per minute. How many pounds of pellets does this spreader broadcast per minute?

100 x .3 = 30 pound of pellets

a. A boat-mounted centrifugal spreader needs to apply a 15% palletized herbicide at a rate of 100 pounds of pellets per acre. Testing reveals the boat treats 1 acre per minute. How many pounds of pellets does this spreader broadcast per minute?

b. A boat-mounted centrifugal spreader needs to apply a 15% palletized herbicide at a rate of 100 pounds of pellets per acre. Testing reveals the boat treats 0.35 acres per minute. How many pounds of pellets does this spreader broadcast per minute?

c. A boat-mounted centrifugal spreader needs to apply a 15% palletized herbicide at a rate of 100 pounds of pellets per acre. Testing reveals the boat treats 0.5 acres per minute. How many pounds of pellets does this spreader broadcast per minute?

10. Determine pump output rate in gallons per minute..

Example: Determine how many acre per minute are treated by a boat-mounted sprayer that treats a swath 18 ft wide while moving 90 ft an average of 36 seconds.

Determine feet per minute

$\frac{90 \text{ ft}}{36 \text{ sec}} = \frac{x \text{ ft}}{60 \text{ sec}}$

150 ft = *x*

Determine acreage

150 ft x 18 ft = 2700

2700 / 43560 = .06 Acres

a. Determine how many acre per minute are treated by a boat-mounted sprayer that treats a swath 20 ft wide while moving 90 ft an average of 36 seconds.

b. Determine how many acre per minute are treated by a boat-mounted sprayer that treats a swath 18 ft wide while moving 90 ft an average of 48 seconds.

c. Determine how many acre per minute are treated by a boat-mounted sprayer that treats a swath 20 ft wide while moving 85 ft an average of 36 seconds.

11. Determine gallons of herbicide

Example: Determine the number of gallons of an algicide containing 4 pounds of active ingredient per gallon of formulation needed to treat a 1-acre pond that has an average depth of 10 ft. The product label specifies a 0.5 ppm active ingredient treatment rate.

Step 1: Determine acre-ft

1 x 10 = 10 acre ft

Step 2: plug in numbers

PPM x acre-ft x 2.7

.5 x 10 x 2.7 = 13.5

Step 3: Cross multiply

$$\frac{4 \text{ lbs a.i.}}{1 \text{ gal}} = \frac{13.5 \text{ lbs}}{x \text{ gal}}$$

3.4 lbs

a. Determine the number of gallons of an algicide containing 5 pounds of active ingredient per gallon of formulation needed to treat a 2-acre pond that has an average depth of 10 ft. The product label specifies a 0.5 ppm active ingredient treatment rate.

12. Determine gallons of herbicide

Example: Determine the maximum number of Galleon aquatic herbicide applications that can be made per growth cycle if each application is to be 30 ppb. The label indicates that the sum of all applications must not exceed 150 ppb maximum per year.

150 / 30 = 5 applications

a. Determine the maximum number of Galleon aquatic herbicide applications that can be made per growth cycle if each application is to be 15 ppb. The label indicates that the sum of all applications must not exceed 150 ppb maximum per year.