Module 4 — Pesticide Calculations (worked, step by step)

CORE exam · 10 practice questions · Area, rate, tank loads, percent solutions, active ingredient and calibration math — with fully worked examples and unit tricks.

Key numbers & facts to memorise

Acre	43,560 sq ft = 0.4047 ha
Gallon	4 qt = 8 pt = 128 fl oz = 3.785 L
Pound	16 oz = 0.4536 kg
Aerial rate	GPA = (GPM × 495) ÷ (mph × swath ft)
Percent solution	Tank gallons × percent = gallons of product

The conversions and constants you must know cold

Calculation questions are guaranteed on the CORE exam, and every one is solvable with a handful of facts. Area: **1 acre = 43,560 square feet**; 1 square mile = 640 acres; 1 acre ≈ 0.4047 hectare. Liquid volume: **1 gallon = 4 quarts = 8 pints = 128 fluid ounces**; 1 gallon ≈ 3.785 litres; 1 fluid ounce ≈ 29.6 mL. Weight: **1 pound = 16 ounces** ≈ 0.4536 kg. Distance: 1 mile = 5,280 feet; 1 rod = 16.5 feet.

The single most valuable habit is **writing the units at every step and cancelling them**. If your units cancel to "gallons," your arithmetic path is right; if they cancel to "gallons per acre squared," you multiplied where you should have divided. This one discipline converts calculation questions from memory tests into bookkeeping, and it works even when the question is phrased in a way you have never seen.

Practise reading numbers off a label rather than out of a textbook, because that is how the exam presents them. A rate might be given as "1.5 pints per acre," "24 fluid ounces per acre," or "0.75 pound active ingredient per acre" — three different arithmetic paths to the same kind of answer, and you should be fluent in all three.

Area, total product and tank loads — a full worked example

Start with a rectangular field 1,320 feet by 660 feet. Area = 1,320 × 660 = 871,200 square feet. Divide by 43,560 → **20 acres**. (Recognise 1,320 ft as a quarter mile and 660 ft as an eighth — these round numbers appear constantly on exams.) For irregular fields, break the shape into rectangles and triangles (triangle = ½ × base × height) and total the pieces.

Now scale a rate. Suppose the label rate is **1.5 pints per acre** and your field is **120 acres**. Total product = 1.5 × 120 = **180 pints**. Convert: 180 ÷ 8 = **22.5 gallons** of product for the job. Next, spray volume: at **2 gallons per acre** carrier, total mix = 2 × 120 = **240 gallons**.

Finally, tank loads for a drone with a **10.5-gallon** tank. Loads = 240 ÷ 10.5 = 22.9, so **23 loads**. Acres per tank = 10.5 ÷ 2 = **5.25 acres**. Product per full tank = 5.25 × 1.5 = **7.9 pints** (about 126 fl oz). Every tank-mix question on the exam is a rearrangement of these four steps: area, total product, total mix, and per-tank quantities.

Percent solutions, active ingredient and dilutions

A **percent solution** means parts of product per hundred parts of finished mix. To mix a 2% solution in a 25-gallon tank: 25 × 0.02 = **0.5 gallon** (64 fluid ounces) of product, topped to 25 gallons. The same logic in reverse tells you the concentration of a mix you have already made — product volume divided by total volume.

For **pounds of active ingredient**, read the label's a.i. content. If a product contains **4 pounds a.i. per gallon** and you apply 1 quart per acre, that is 0.25 gallon × 4 = **1.0 pound a.i. per acre**. Going the other way: to apply 0.5 lb a.i./A with a 4 lb/gal product you need 0.125 gallon (16 fl oz) per acre. Dry formulations work the same way using the percentage: 2 pounds of a 75% WP supplies 1.5 pounds a.i.

Exams also test dilution scaling: if a rate is given per 1,000 square feet and you need it per acre, multiply by 43.56 (because an acre is 43,560 sq ft). This is a common trap in turf and ornamental questions, and the arithmetic is trivial — but only if you notice the units changed.

Calibration math and the drone-specific formula

Calibration is the procedure that proves your equipment actually delivers the label rate. The general approach is the same for any sprayer: measure output over a known area or time, compare to your target, then adjust flow, speed or swath until measured equals labelled. Recalibrate after any change to nozzles, atomiser settings, height, speed or payload — and record the result, because a calibration log is powerful evidence that you applied correctly.

For aerial and drone application the working formula is **GPA = (gallons per minute × 495) ÷ (mph × swath in feet)**. The 495 constant converts units so the answer lands in gallons per acre. Example: 1.6 gal/min at 15 mph with a 20-foot effective swath gives (1.6 × 495) ÷ (15 × 20) = 792 ÷ 300 = **2.64 GPA**. Rearrange the same equation to solve for the flow rate you need at a target GPA, which is how you set up before a job rather than discovering the error afterwards.

Two cautions the exam rewards. First, use **effective** swath, not the physical boom width — the edges of the pattern receive less deposit, so effective swath is narrower and your planned overlap depends on it. Second, verify with water-sensitive paper laid across the swath at canopy height at least once per season; it shows droplet density and pattern uniformity, which no arithmetic can confirm on its own.

Practice questions

Answer these closed-book, then check against the answer key that follows. Ohio requires 70% to pass.

1. How many square feet are in one acre?

A) 10,000
B) 43,560
C) 5,280
D) 640

2. A field measures 1,320 ft by 660 ft. How many acres is it?

A) 10 acres
B) 20 acres
C) 30 acres
D) 40 acres

3. The label rate is 1.5 pt/A. How much product does a 120-acre field require?

A) 90 pints
B) 180 pints (22.5 gallons)
C) 240 pints
D) 120 pints

4. You are applying 2 GPA to 120 acres with a 10.5-gallon tank. How many tank loads?

A) 12
B) 18
C) 23
D) 30

5. How much product makes a 2% solution in a 25-gallon tank?

A) 0.25 gallon
B) 0.5 gallon (64 fl oz)
C) 1 gallon
D) 2 gallons

6. A product contains 4 lb active ingredient per gallon. Applying 1 quart per acre delivers:

A) 0.5 lb a.i./A
B) 1.0 lb a.i./A
C) 2.0 lb a.i./A
D) 4.0 lb a.i./A

7. Using GPA = (GPM × 495) ÷ (mph × swath ft), what is the rate at 1.6 GPM, 15 mph, 20-ft swath?

A) 1.32 GPA
B) 2.64 GPA
C) 5.28 GPA
D) 0.66 GPA

8. How many fluid ounces are in a gallon?

A) 64
B) 96
C) 128
D) 160

9. Calibration should be repeated:

A) Only when you buy the sprayer
B) After any change to nozzles, speed, height or payload
C) Once a decade
D) Only if the tank leaks

10. 2 pounds of a 75% wettable powder supplies how much active ingredient?

A) 0.75 lb
B) 1.5 lb
C) 2.0 lb
D) 2.75 lb

Answer key & explanations

1. B) 43,560 — One acre = 43,560 square feet. (5,280 is feet per mile; 640 is acres per square mile.)

2. B) 20 acres — 1,320 × 660 = 871,200 sq ft; 871,200 ÷ 43,560 = 20 acres.

3. B) 180 pints (22.5 gallons) — 1.5 × 120 = 180 pints; 180 ÷ 8 pt/gal = 22.5 gallons.

4. C) 23 — Total mix = 2 × 120 = 240 gal; 240 ÷ 10.5 = 22.9, so 23 loads.

5. B) 0.5 gallon (64 fl oz) — 25 × 0.02 = 0.5 gallon of product, topped off to 25 gallons of finished mix.

6. B) 1.0 lb a.i./A — 1 quart = 0.25 gallon; 0.25 × 4 lb/gal = 1.0 lb a.i. per acre.

7. B) 2.64 GPA — (1.6 × 495) ÷ (15 × 20) = 792 ÷ 300 = 2.64 gallons per acre.

8. C) 128 — 1 gallon = 128 fluid ounces = 8 pints = 4 quarts.

9. B) After any change to nozzles, speed, height or payload — Any change that affects flow, speed or swath changes the delivered rate — recalibrate and log it.

10. B) 1.5 lb — 2 lb × 0.75 = 1.5 pounds of active ingredient.