Topic: Unit multipliers

Question: Convert from feet to inches.

3 ft

Answer choices:

A $\frac{1}{4}$ in

B 4 in

C 3 in

D 36 in

Solution: D

We put inches in the numerator and feet in the denominator, in order to end up with the units we want.

$$3 \text{ ft} \cdot \frac{12 \text{ in}}{1 \text{ ft}}$$

$$36 \text{ in}$$

Topic: Unit multipliers

Question: Convert from cubic centimeters to cubic meters.

$6{,}000\ \text{cm}^3$

Answer choices:

A $0.6\ \text{m}^3$

B $0.06\ \text{m}^3$

C $0.006\ \text{m}^3$

D $0.0006\ \text{m}^3$

Solution: C

We put meters in the numerator and centimeters in the denominator, in order to get to the units we want. Because we're dealing with cubic centimeters, we need three factors of each (when we were dealing with square units, we only needed two factors, and when we were dealing with linear units, we only needed one factor).

$$6{,}000 \text{ cm}^3 \cdot \frac{1 \text{ m}}{100 \text{ cm}} \cdot \frac{1 \text{ m}}{100 \text{ cm}} \cdot \frac{1 \text{ m}}{100 \text{ cm}}$$

The cm^3 in the numerator cancels out the $\text{cm} \cdot \text{cm} \cdot \text{cm}$ in the denominator, and the $\text{m} \cdot \text{m} \cdot \text{m}$ in the numerator can be written as m^3, so this becomes

$$\frac{6{,}000 \text{ m}^3}{(100)(100)(100)}$$

$$\frac{6{,}000}{1{,}000{,}000} \text{ m}^3$$

Now we'll reduce the fraction to lowest terms.

$$\frac{6{,}000 \div 1{,}000}{1{,}000{,}000 \div 1{,}000} \text{ m}^3$$

$$\frac{6}{1{,}000} \text{ m}^3$$

$$0.006 \text{ m}^3$$

Topic: Unit multipliers

Question: Convert from square yards to square centimeters.

3 yd^2, assuming 2.54 cm in 1 in

Answer choices:

A 300 cm^2

B $3{,}888$ cm^2

C 274.32 cm^2

D $25{,}083.82$ cm^2

Solution: D

Since we know there are 3 ft in 1 yd, we put feet in the numerator and yards in the denominator in order to convert from yards to feet. Because we're dealing with square yards, we need two factors of each.

$$3 \text{ yd}^2 \cdot \frac{3 \text{ ft}}{1 \text{ yd}} \cdot \frac{3 \text{ ft}}{1 \text{ yd}}$$

$$3 \text{ yd}^2 \cdot \frac{9 \text{ ft}^2}{1 \text{ yd}^2}$$

The yd units will all cancel.

$$27 \text{ ft}^2$$

Since we know there are 12 in in 1 ft, we put inches in the numerator and feet in the denominator in order to convert from feet to inches. Because we're dealing with square feet, we need two factors of each.

$$27 \text{ ft}^2 \cdot \frac{12 \text{ in}}{1 \text{ ft}} \cdot \frac{12 \text{ in}}{1 \text{ ft}}$$

$$27 \text{ ft}^2 \cdot \frac{144 \text{ in}^2}{1 \text{ ft}^2}$$

The ft units will all cancel.

$$3{,}888 \text{ in}^2$$

Since we know there are 2.54 cm in 1 in, we put centimeters in the numerator and inches in the denominator in order to convert from inches

to centimeters. Because we're dealing with square inches, we need two factors of each.

$$3{,}888 \text{ in}^2 \cdot \frac{2.54 \text{ cm}}{1 \text{ in}} \cdot \frac{2.54 \text{ cm}}{1 \text{ in}}$$

$$3{,}888 \text{ in}^2 \cdot \frac{6.4516 \text{ cm}^2}{1 \text{ in}^2}$$

The in units will all cancel.

$$25{,}083.82 \text{ cm}^2$$

If we wanted to do the conversion in one step, we could have written the conversion as

$$3 \text{ yd}^2 \cdot \frac{3 \text{ ft}}{1 \text{ yd}} \cdot \frac{3 \text{ ft}}{1 \text{ yd}} \cdot \frac{12 \text{ in}}{1 \text{ ft}} \cdot \frac{12 \text{ in}}{1 \text{ ft}} \cdot \frac{2.54 \text{ cm}}{1 \text{ in}} \cdot \frac{2.54 \text{ cm}}{1 \text{ in}}$$

The only units that remain after cancellation are cm.

$$3 \cdot 3 \cdot 3 \cdot 12 \cdot 12 \cdot 2.54 \text{ cm} \cdot 2.54 \text{ cm}$$

$$25{,}083.82 \text{ cm}^2$$