

The formula

The cabinet maker wants you to figure out the formula that would give the total area of one armoire. This way, he could use an Excel-type spreadsheet to quickly calculate how much wood is needed to build one armoire.

(Reminder: Area of a rectangle = $b \times h$)

Work

$$\text{Width} = 3x + 4$$

$$\text{Depth} = x$$

$$\text{Height} = 7x - 20$$

Total area for 1 armoire:

$$\text{Front and Back: } 2 \times \text{width} \times \text{height} = 2(3x + 4)(7x - 20) = 42x^2 - 64x - 160$$

$$\text{Left and Right: } 2 \times \text{depth} \times \text{height} = 2(x)(7x - 20) = 14x^2 - 40x$$

$$\text{Top and Bottom: } 2 \times \text{width} \times \text{depth} = 2(3x + 4)(x) = 6x^2 + 8x$$

$$\text{Total area} = (42x^2 - 64x - 160) + (14x^2 - 40x) + (6x^2 + 8x) = 62x^2 - 96x - 160$$

So the formula is: $62x^2 - 96x - 160$

Wood costs

To help you figure out how much wood is needed, the cabinet maker informs you that for this armoire, the sum of the **dimensions** comes up to exactly 314 centimetres.

The cabinet maker also tells you that he does not want to spend less than 50% of his budget, or more than 75%, on wood.

Here are the wood types you can choose from:

Wood types

<u>Type</u>	<u>Price (\$/m²)</u>
Teak	18.00
Rosewood	25.00
Brazilian Tulipwood	50.00
Ebony	70.00

(Reminder: 1 m = 100 cm and 1 m² = 10 000 cm², Area of a rectangle = b x h)

Work

Width = $3x + 4$
Depth = x
Height = $7x - 20$
 $3x + 4 + x + 7x - 20 = 314$
 $11x - 16 = 314$
 $11x = 330$
 $x = 30$ cm

Costs:

Teak: $63.312 \times 18.00 = \$1139.62$
Brazilian Tulipwood: $63.312 \times 50.00 = \$3165.60$

50% of budget = $0.50 \times 4500 = \$2250$

Only the Brazilian Tulipwood falls in that range.
Wood cost: \$3165.60

Width = $3(30)+4 = 94$ cm or 0.94 m
Depth = 30 cm or 0.30 m
Height = 190 cm or 1.90 m
Total area for 1 armoire:
Front and Back: $0.94 \times 1.90 \times 2 = 3.572$ m²
Left and Right: $0.30 \times 1.90 \times 2 = 1.14$ m²
Top and Bottom: $0.94 \times 0.30 \times 2 = 0.564$ m²
Total = 5.276 m²
12 armoires: $12 \times 5.276 = 63.312$ m²

Rosewood: $63.312 \times 25.00 = \$1582.80$
Ebony: $63.312 \times 70.00 = \$4431.84$

75% of budget = $0.75 \times 4500 = \$3375$

The trim and the hardware

The trim is only sold in strips of 4 metres at a cost of \$28.00 per strip. For each armoire, the cabinet maker will need 24 screws at \$0.15 each, 2 handles at \$6.50 each, and 4 hinges at \$2.75 each. You need to figure out the total cost for the trim and the hardware to build the armoires.

Work

Hardware for 1 armoire:

$$24 \times 0.15 = \$3.60$$

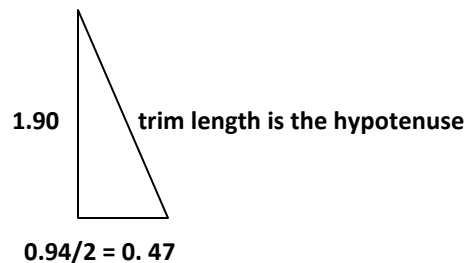
$$2 \times 6.50 = \$13.00$$

$$4 \times 2.75 = \$11.00$$

$$\text{Total} = \$27.60$$

$$\text{For 12 armoires} = 12 \times 27.60 = \underline{\$331.20}$$

Trim:



$$C^2 = a^2 + b^2$$

$$C^2 = 1.90^2 + 0.47^2$$

$$C^2 = 3.8309$$

$$C \approx 1.957 \text{ m}$$

4 lengths needed x 12 armoires:

$$4 \times 12 \times 1.957 \approx 93.95 \text{ m}$$

Number of strips needed: $93.95 / 4 \approx 23.49$ so 24

$$\text{Cost of the strips: } 24 \times 28.00 = \underline{\$672.00}$$

Costs so far:	Wood	+	Trim	+	Hardware	
	\$3165.60	+	\$672.00	+	\$331.20	= \$4168.80

The varnish

The varnish costs \$12.00 per litre and each litre of varnish covers 8 m². You need to figure out the maximum number of coats of varnish that can be used on the armoires to stay within budget.

Work

$$\text{Money left} = \$4500 - 4168.80 = \$331.20$$

$$\text{Total area for 12 armoires} = 63.312 \text{ m}^2$$

$$\text{Number of litres needed} = 63.312 / 8 = 7.914 \text{ so we round up to 8 litres.}$$

$$\text{Cost of varnish for 1 coat (12 armoires)} = 8 \text{ litres} * 12.00 \text{ \$/L} = \$96.00$$

Let x represent the number of coats that can be applied,

$$96x \leq 331.20$$

$$\underline{96x} \leq \underline{331.20}$$

$$96 \quad 96$$

$$x \leq 3.45$$

So only 3 coats of varnish can be applied.