Fashion Puzzle

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Again we have a puzzle from the Sherlock Holmes puzzle book by Dr. Watson (aka Tim Dedopulos) ([1] p.134).

On one occasion, Holmes and I were asked to solve the robbery of a number of dresses from the workshop of a recently deceased ladies' tailor to the upper echelons of society. Holmes took a short look at the particulars of the case, and sent them all back to the gown-maker's son with a scribbled note to the effect that it could only be one particular seamstress, with the help of her husband.

However, glancing through my observations some period later, I observed certain facts about the robbery which led me to an interesting little exercise. The stock at the workshop had been very recently valued at the princely sum of £1,800, and when examined after the theft, comprised of precisely 100 completed dresses in a range of styles, but of equal valuation. However, there was no remaining record of how many dresses had been there beforehand. The son did recall his father stating, of the valuation, that if he'd had thirty dresses more, then a valuation of £1,800 would have meant £3 less per dress.

Are you able to calculate how many dresses were stolen?

My Solution

Let x be the number of missing dresses and c the cost per dress. Then we have the following two equations from the story

$$1{,}800 = (100 + x)c \quad \text{and} \quad 1{,}800 = (100 + x + 30)(c - 3)$$

It turns out that the arithmetic is simpler if we solve for c first. Then

$$\frac{1800}{c} = 100 + x \quad \text{and} \quad \frac{1800}{c-3} = 130 + x$$

Subtracting the first equation from the second yields

$$1800\left(\frac{1}{c-3} - \frac{1}{c}\right) = 30$$

or

$$0 = c^2 - 3c - 180 = (c - 15)(c + 12)$$

Therefore, c = £15 per dress. (I actually solved the quadratic with the quadratic formula.) So

$$1{,}800 = (100 + x)(15)$$

or

$$x = 120 - 100 = 20 \text{ dresses.}$$

Dr. Watson's Solution

The answer is 20 dresses. If there are x dresses costing y each, then

$$x\,y = 1800.$$

Furthermore, we also know that

$$(x + 30)(y - 3) = 1800.$$

Since $y = 1800/x$, then

$$(x + 30)(1800/x - 3) = 1800$$

and

$$1800/(x + 30) + 3 = 1800/x.$$

Thus

$$3(x + 30)x + 1800x = 1800(x + 30)$$

and

$$3x^2 + 90x - 54000 = 0$$

We've discussed solving quadratic equations earlier; the solution to this gives you a positive quadratic root of $x = 120$. There were 120 dresses, each costing an eye-watering £15, of which 20 had been stolen.

References

[1] Dedopulos, Tim, *The Sherlock Holmes Puzzle Collection: The Lost Cases*, Metro Books, Sterling Publishing Co., New York, Carlton Books Ltd., London, 2015.