



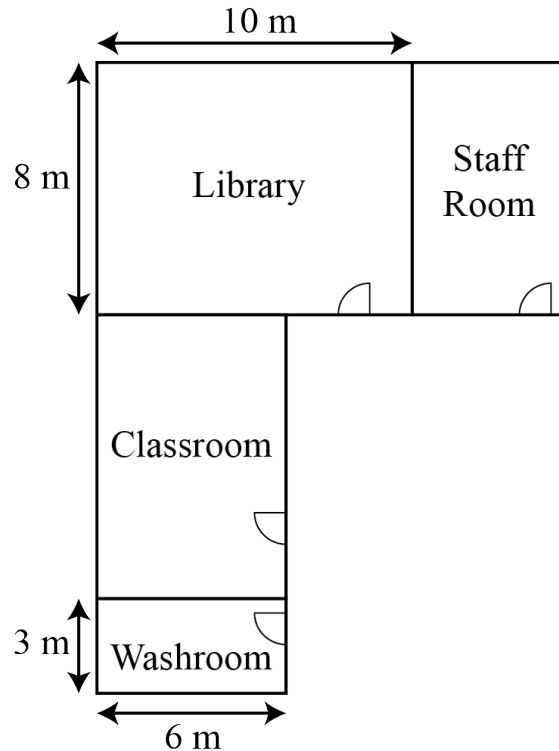
Problem of the Week

Problem A and Solution

Room to Grow

Problem

Ada Lovelace Public School needs to add a new wing to its main building that includes a classroom, library, staff room, and washroom. The plans for the addition are shown, with all new rooms being rectangular; however, some of the measurements are missing.



Fortunately, the contractor remembered the following extra details:

The length of the classroom is three times the width of the washroom.
The width of the staff room is half the length of the library.

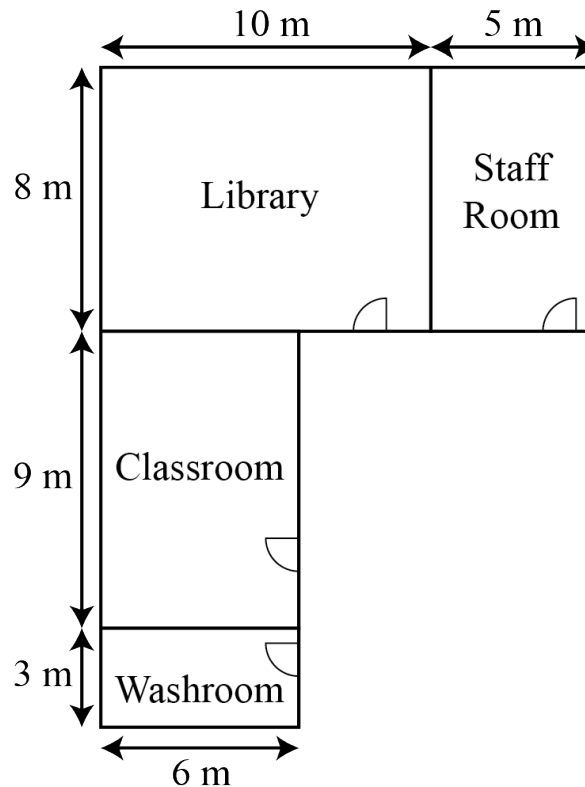
When describing the dimensions of a rectangle, the contractor uses *length* to describe the longer side, and *width* to describe the shorter side.

- What are the missing dimensions of the classroom and the staff room?
- What is the total floor area of the four new rooms?



Solution

- (a) Since the length of the classroom is three times the width of the washroom, its length is $3 \times 3 = 9$ m. Since the width of the staff room is half the length of the library, its width is $10 \div 2 = 5$ m. These dimensions are shown in the diagram.



- (b) There are many ways to determine the total floor area.

Solution 1: We calculate the area of each room and add those areas together.

- The area of the washroom is $6 \times 3 = 18$ m².
- The area of the classroom is $9 \times 6 = 54$ m².
- The area of the library is $8 \times 10 = 80$ m².
- The area of the staff room is $8 \times 5 = 40$ m².

Therefore, the total floor area is $18 + 54 + 80 + 40 = 192$ m².

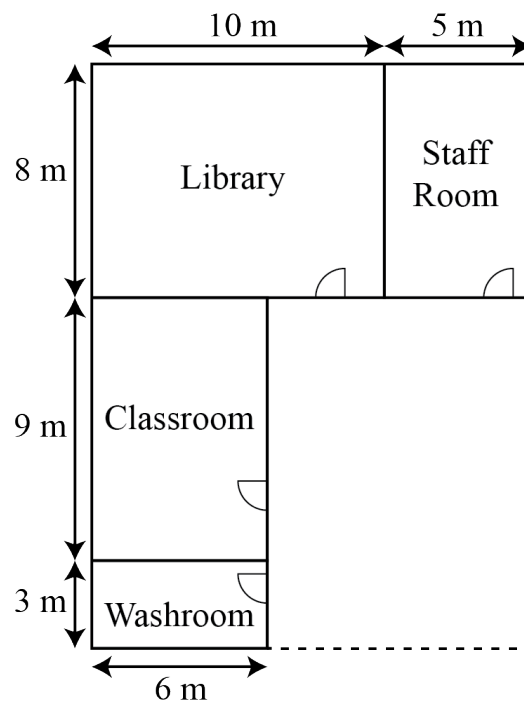
Solution 2: We calculate the area of the classroom based on the area of the washroom, and calculate the area of the staff room based on the area of the library. Since the length of the classroom is three times the width of the washroom, but the width of the classroom is the same as the length of the



washroom, the area of the classroom is three times the area of the washroom. We can imagine that we could put three washrooms side-by-side and they would fill in the same area as the classroom. Since the area of the washroom is $6 \times 3 = 18 \text{ m}^2$, it follows that the area of the classroom is $18 \times 3 = 54 \text{ m}^2$. Similarly, the area of the staff room would fill half of the area of the library. Since the area of the library is $8 \times 10 = 80 \text{ m}^2$, it follows that the area of the staff room is $80 \div 2 = 40 \text{ m}^2$.

Therefore, the total floor area is $18 + 54 + 80 + 40 = 192 \text{ m}^2$.

Solution 3: We square off the diagram to create a large rectangle, as shown.



This large rectangle measures $10 + 5 = 15 \text{ m}$ across the top and $8 + 9 + 3 = 20 \text{ m}$ along the side. The total area of this rectangle is then $15 \times 20 = 300 \text{ m}^2$.

However, there is a section of the large rectangle that is not part of the floor plan, and hence its area needs to be subtracted. That section is a rectangle with length $3 + 9 = 12 \text{ m}$ and width $15 - 6 = 9 \text{ m}$. The area of the section is then $12 \times 9 = 108 \text{ m}^2$.

Therefore, the total floor area is equal to $300 - 108 = 192 \text{ m}^2$.