Quadratic Equations – Applications

EXERCISE 21J

1 The sum of a number and its square is 110. Find the number.

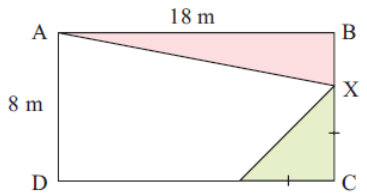
2 The square of a number is equal to 12 more than four times the number. Find the number.

3 The sum of two numbers is 6 and the sum of their squares is 90. Find the numbers.

4 When a number is subtracted from 2, the result is equal to the reciprocal of the original number. Find the number.

5 The base of a triangle is 5 m longer than its altitude. If its area is 33 m^2, find the length of the base.

6



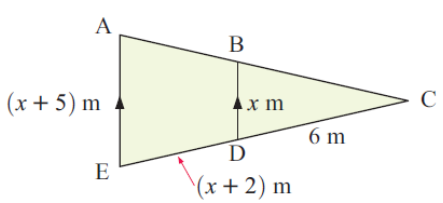
In the figure alongside, the two shaded triangles have equal area. Find the length of BX.

7 A rectangular enclosure is made from 45 m of fencing. The area enclosed is 125 m^2. Find the dimensions of the enclosure.

8 Two numbers have a sum of 5, and the sum of their reciprocals is 1. Find the exact numbers.

9 Find the exact value of x in:

a



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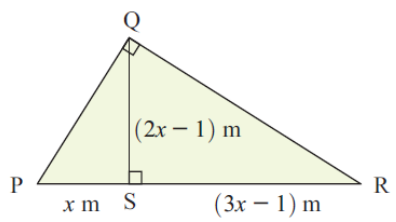
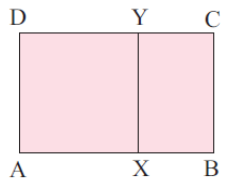


10 ABCD is a rectangle in which AB = 21 cm.
The square AXYD is removed and the remaining rectangle has area 80 cm^2. Find the length of BC.



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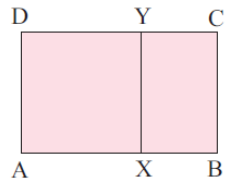
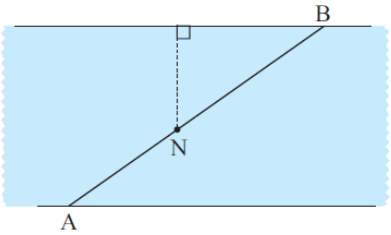


11 A right angled triangle has sides 2 cm and 16 cm respectively shorter than its hypotenuse. Find the length of each side of the triangle.

12 Nathan is swimming across a river from A to B. He is currently at N, having swum 30 m. If he was to change course and head directly for the opposite bank, he will save himself 20 m of swimming. Given that the river is 50 m wide, how much further must Nathan swim to get to B?



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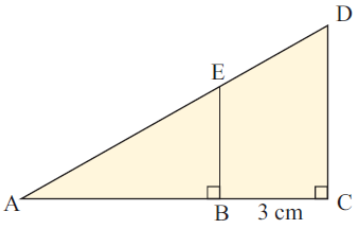


AB is 2 cm longer than BE. DC is 3 cm less than twice the length of BE.

a Explain why triangles ABE and ACD are similar.

b If BE $= x$ cm, show that $x^2 - 4x - 6 = 0$.

c Hence, show that BE $= 2 + \sqrt{10}$ cm.

14 In a 180 km bicycle race, a cyclist took $(t - 14)$ hours to complete the race, cycling at a constant speed of $(t + 10)$ km/h. Find:

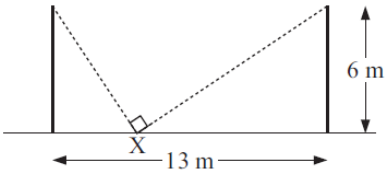
a the value of t

b the time the cyclist took to complete the race

c the speed of the cyclist.

15 The numerator of a fraction is 5 less than the denominator. If both the numerator and denominator are increased by 4, the fraction is tripled in value. Find the original fraction.

16 Two flagpoles are 6 m high and 13 m apart. Wires supporting the flagpoles are connected to a hook on the ground at X as illustrated. If the wires are perpendicular to each other, find the distance between the hook and the nearer flagpole.



17 The sum of a number and twice its reciprocal is $2\frac{5}{6}$. Find the number.

18 An object is projected into the air with a velocity of 80 m/s. Its height after t seconds is given by the function $h(t) = 80t - 5t^2$ metres.

a Calculate the height after: **i** 1 second **ii** 3 seconds **iii** 5 seconds.

b Calculate the time(s) at which the height is: **i** 140 m **ii** 0 m.

c Explain your answers in part **b**.

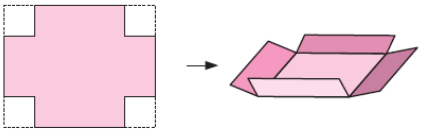
19 A cake manufacturer finds that the profit from making x cakes per day is given by the function $P(x) = -\frac{1}{2}x^2 + 36x - 40$ dollars.

a Calculate the profit if: **i** 0 cakes **ii** 20 cakes are made per day.

b How many cakes per day are made if the profit is \$270?

20 Delivery boys Max and Sam each have 1350 newspapers to deliver. Max can deliver 75 more newspapers each hour than Sam, and finishes his job 1.5 hours faster. How long does each boy take to deliver their newspapers?

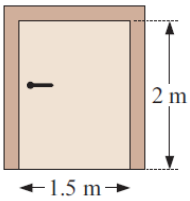
21 A sheet of cardboard is 15 cm long and 10 cm wide. It is to be made into an open box which has a base area of 66 cm^2, by cutting out equal squares from the four corners and then bending the edges upwards.
Find the size of the squares to be cut out.



22 A doorway which is 1.5 m wide and 2 m high is to be surrounded by timber framing. The timber framing has a total area of 0.5 m^2.

a If the timber framing is x m wide, show that $4x^2 + 11x - 1 = 0$.

b Find the width of the timber framing to the nearest millimetre.



23 A right angled triangle has perimeter 40 m and area 60 m^2. Find the lengths of the sides of the triangle.