Factorising and Solving Quadratics

1) Factorise and solve the following equations:

a) $x^2 + 5x + 6 = 0$

b) $x^2 + 9x + 20 = 0$

c) $x^2 + x - 6 = 0$

d) $x^2 + 5x - 24 = 0$

e) $x^2 - 6x + 8 = 0$

f) $x^2 - 3x - 28 = 0$

g) $2x^2 + 7x + 3 = 0$

h) $6x^2 + 11x + 3 = 0$

i) $3x^2 + 13x - 10 = 0$

j) $3x^2 - 34x + 63 = 0$

2) Lucy said that -1 is the only solution of x that satisfies the equation
$x^2 + 2x + 1 = 0$

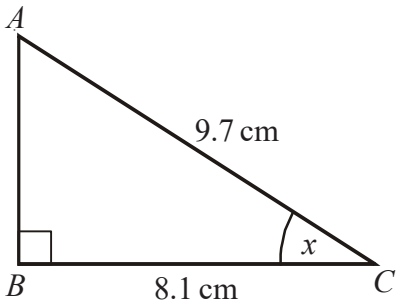
Was Lucy correct?
Show working to justify your answer

3) Ben said that -5 is the only solution of x that satisfies the equation
$x^2 + 10x + 25 = 0$

Was Ben correct?
Show working to justify your answer

Trigonometry

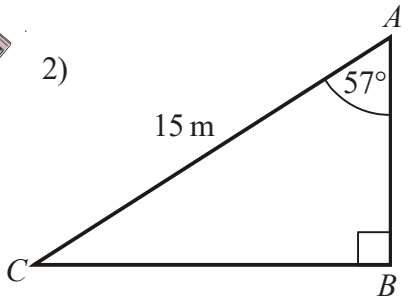
1)



ABC is a right-angled triangle.
AC = 9.7 cm
BC = 8.1 cm

Calculate the size of the angle marked *x*.
Give your answer correct to three significant figures.

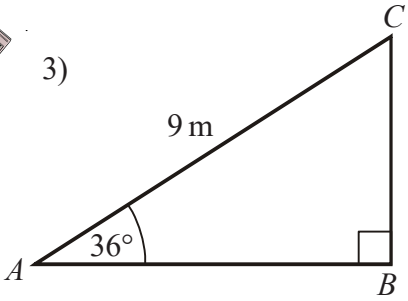
2)



ABC is a right-angled triangle.
AC = 15 m
Angle *CAB* = 57°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

3)

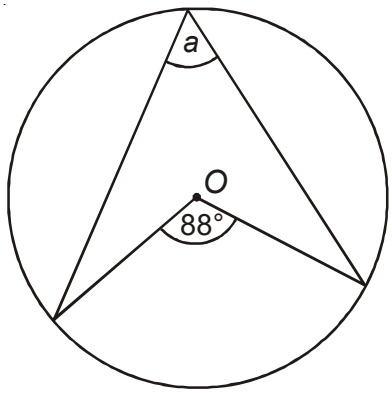


ABC is a right-angled triangle.
AC = 9 m
Angle *CAB* = 36°

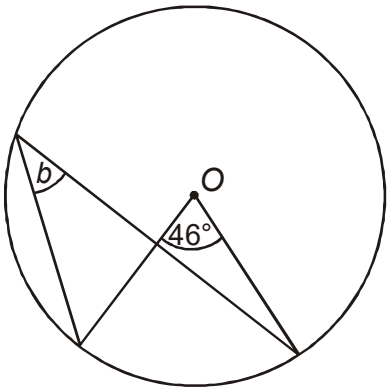
Calculate the length of *AB*.
Give your answer correct to three significant figures.

Circle Theorems

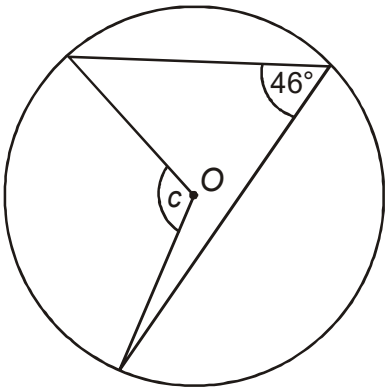
1) a = ____



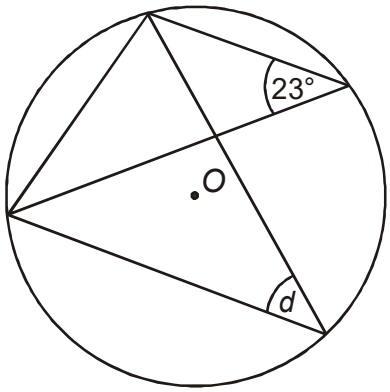
2) b = ____



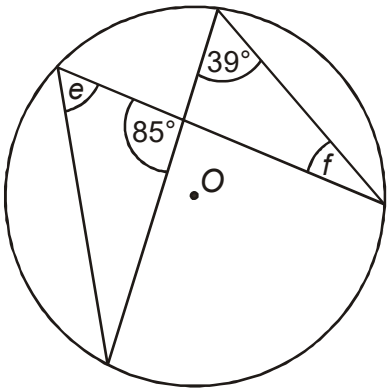
3) c = ____



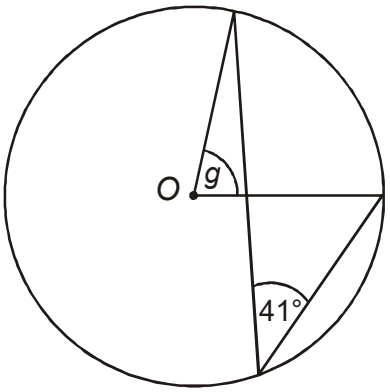
4) d = ____



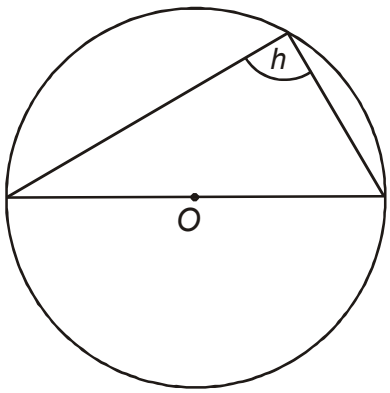
5) e = ____ f = ____



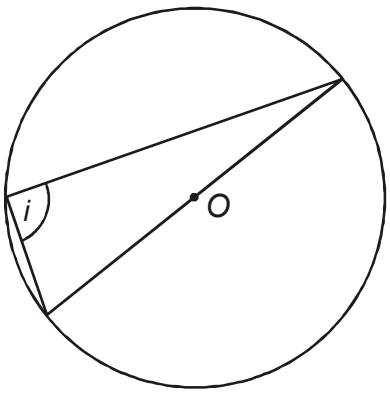
6) g = ____



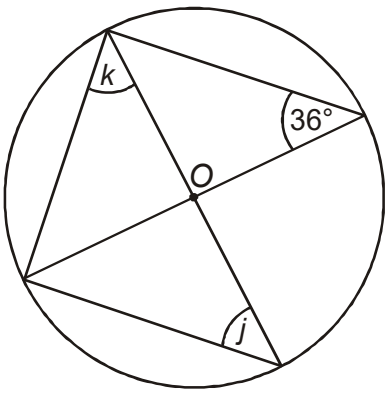
7) h = ____



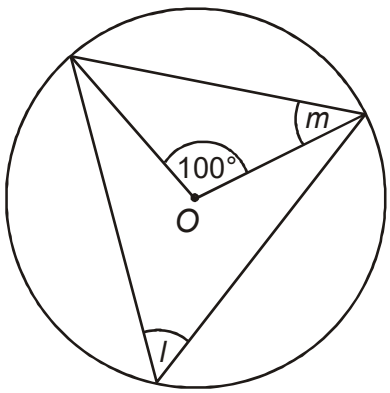
8) i = ____



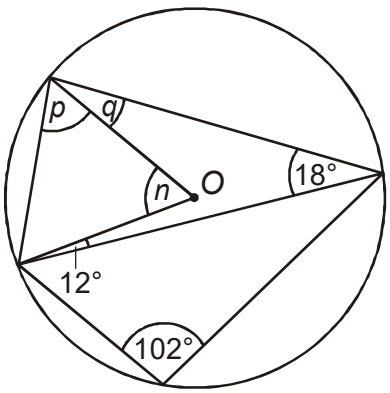
9) j = ____ k = ____



10) l = ____ m = ____



11) n = ____ p = ____ q = ____



Fractional Indices

1) Simplify the following:

a) $y^4 \times y^5$

b) $x^2 \times x^6$

c) $(p^4)^5$

d) $(x^3)^2$

e) $(x^4)^{-2}$

f) $(x^{-3})^{-5}$

g) $x^7 \div x^2$

h) $\dfrac{t^5}{t^3}$

2) Work out the value of the following, leaving your answer in fraction form when necessary

a) 5^0

b) 4^{-2}

c) 5^{-3}

d) $49^{\frac{1}{2}}$

e) $8^{\frac{1}{3}}$

f) $32^{\frac{2}{5}}$

g) $16^{-\frac{1}{2}}$

h) $27^{-\frac{1}{3}}$

i) $64^{-\frac{2}{3}}$

3) $5\sqrt{5}$ can be written in the form 5^n.

Calculate the value of n.

4) $2\sqrt{8}$ can be written in the form 2^n.

Calculate the value of n.

5) $a = 2^x$, $b = 2^y$

Express in terms of a and b

(i) 2^{x+y}

(ii) 2^{2x}

(iii) 2^{x+2y}

Factorising Hard Quadratics

1) Factorise the following:

a) $2x^2 + 7x + 3$

b) $3x^2 + 5x - 2$

c) $6x^2 - 11x + 3$

d) $8x^2 + 10x + 3$

e) $6x^2 - 7x - 20$

f) $4x^2 - 4x - 15$

2) Solve the following:

a) $5x^2 + 9x - 2 = 0$

b) $6x^2 + 5x - 6 = 0$

c) $12x^2 + 25x + 7 = 0$

d) $8x^2 - 14x - 15 = 0$

e) $10x^2 - 43x - 30 = 5$

f) $4x^2 - 8x + 2 = 7$

Direct and Inverse Proportion

1) M is directly proportional to L^3.

When $L = 2$, $M = 160$

Find the value of M when $L = 3$

2) y is directly proportional to x.

When $x = 500$, $y = 10$

a) Find a formula for y in terms of x.

b) Calculate the value of y when $x = 350$

3) D is proportional to S^2.

$D = 900$ when $S = 20$

Calculate the value of D when $S = 25$

4) P is inversely proportional to V.

When $V = 8$, $P = 6$

a) Find a formula for P in terms of V.

b) Calculate the value of P when $V = 2$

5) The time, T seconds, for a hot sphere to cool is proportional to the square root of the surface area, A m^2, of the sphere.

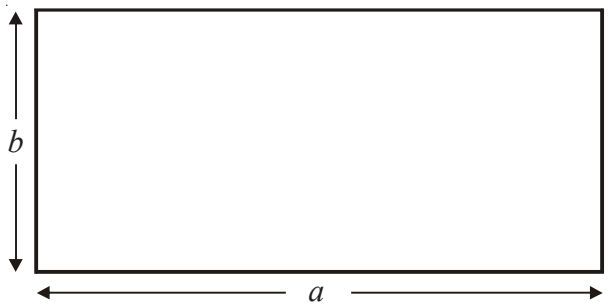
When $A = 100$, $T = 30$.

Find the value of T when $A = 60$.
Give your answer correct to 3 significant figures.

Upper and Lower Bounds

1) Here is a rectangle.

$a = 8.4$ cm correct to 1 decimal place.
$b = 3.6$ cm correct to 1 decimal place.



a) Calculate the upper bound of the area of the rectangle.
Write down all the figures on your calculator.

b) Find the area of this rectangle correct to an appropriate number of significant figures.

2) Terry measured the length and the width of a rectangle.

He measured the length to be 745 mm correct to the nearest 5 mm.
He measured the width to be 300 mm correct to the nearest 5 mm.

a) Calculate the lower bound for the area of this rectangle.
Give your answer correct to 3 significant figures.

b) Calculate the upper bound for the perimeter of the rectangle.

3) The voltage V of an electronic circuit is given by the formula

$$\boxed{V = IR}$$

where I is the current in amps
and R is the resistance in ohms.

Given that $V = 217$ correct to three significant figures,
$R = 12.4$ correct to three significant figures,

calculate the lower bound of I.

4) Sara drove for 237 miles, correct to the nearest mile.
She used 27.2 litres of petrol, to the nearest tenth of a litre.

$$\text{Petrol consumption} = \frac{\text{Number of miles travelled}}{\text{Number of litres of petrol used}}$$

Work out the upper bound for the petrol consumption for Sara's journey.
Give your answer correct to 2 decimal places.

Surds

1) Simplify the following:

a) $\sqrt{7} \times \sqrt{7}$

b) $\sqrt{3} \times \sqrt{3}$

c) $\sqrt{20}$

d) $\sqrt{24}$

e) $\sqrt{72}$

f) $\sqrt{200}$

g) $\sqrt{\frac{2}{25}}$

2) Simplify the following:

a) $\sqrt{2} \times \sqrt{18}$

b) $\sqrt{8} \times \sqrt{32}$

c) $\sqrt{99} \times \sqrt{22}$

d) $\sqrt{45} \times \sqrt{20}$

e) $\sqrt{18} \times \sqrt{128}$

f) $\sqrt{28} \times \sqrt{175}$

3) Expand and simplify where possible:

a) $\sqrt{3}(3-\sqrt{3})$

b) $\sqrt{2}(6+2\sqrt{2})$

c) $\sqrt{7}(2+3\sqrt{7})$

d) $\sqrt{2}(\sqrt{32}-\sqrt{8})$

4) Expand and simplify where possible:

a) $(1+\sqrt{2})(1-\sqrt{2})$

b) $(3+\sqrt{5})(2-\sqrt{5})$

c) $(\sqrt{3}+2)(\sqrt{3}+4)$

d) $(\sqrt{5}-3)(\sqrt{5}+1)$

e) $(2+\sqrt{7})(2-\sqrt{7})$

f) $(\sqrt{6}-3)^2$

5) Work out the following, giving your answer in its simplest form:

a) $\frac{(5+\sqrt{3})(5-\sqrt{3})}{\sqrt{22}}$

b) $\frac{(4-\sqrt{5})(4+\sqrt{5})}{\sqrt{11}}$

c) $\frac{(3-\sqrt{2})(3+\sqrt{2})}{\sqrt{14}}$

d) $\frac{(\sqrt{3}+1)^2}{\sqrt{3}}$

e) $\frac{(\sqrt{5}+3)^2}{\sqrt{20}}$

f) $\frac{(5-\sqrt{5})(2+2\sqrt{5})}{\sqrt{20}}$

Algebraic Fractions

1) Simplify fully

a) $\frac{9x^2}{21x^3}$

b) $\frac{10xy^3}{5y^2}$

c) $\frac{18a^3b^2}{2ab^2}$

d) $\frac{4x^2+12x}{10x}$

e) $\frac{2a^2b-14a^2b^3}{6a^3b^3}$

f) $\frac{5x^2y+5xy^2}{10x^2y^2}$

2) Simplify fully

a) $\frac{x^2+x}{x^2+6x+5}$

b) $\frac{x^2-6x+8}{2x^2-8x}$

c) $\frac{x^2+7x+10}{x^2+5x}$

3) a) Factorise $4x^2-12x+9$

b) Simplify $\frac{6x^2-7x-3}{4x^2-12x+9}$

Inverse Functions

1) Find $f^{-1}(x)$ if $f(x) = \frac{x}{4} + 3$

2) a) Find $f^{-1}(x)$ where $f(x) = 2x - 3$

b) Find $f^{-1}(19)$

3) a) Find $f^{-1}(x)$ where $f(x) = x^3 - 1$

b) Find $f^{-1}(26)$

4) Find $f^{-1}(x)$ where $f(x) = \frac{4x - 1}{x}$

5) Find $f^{-1}(x)$ where $f(x) = \frac{2x}{x + 5}$

Composite Functions

1) For all values of x,

$f(x) = x^2 - 2$, $g(x) = x + 6$

a) Find f(5)

b) Find f(-1)

c) Find g(3)

d) Find g(-5)

2) For all values of x,

$f(x) = x^2 - 2$, $g(x) = x + 6$

a) Find fg(3)

b) Find gf(3)

c) Find gf(0)

3) For all values of x,

$f(x) = x^2 + 3x$, $g(x) = x + 5$

a) Find $fg(x)$

b) Find $gf(x)$

4) For all values of x,

$f(x) = x + 5$, $g(x) = x^2 - 2$

Solve $fg(x) = gf(x)$