

Session 9: Algebra 2 – Quadratics and Algebraic Fractions

1 Simplify fully:

a) $\frac{x^2 - 18x + 72}{x - 6}$ (3)

b) $\frac{x^2 - 9x + 18}{x^2 - 5x - 6}$ (3)

c) $\frac{3x^2 - 32x + 64}{3x^2 - 25x + 8}$ (3)

d) $\frac{x^2 - 36}{2x^2 - 9x - 18}$ (3)

e) $\frac{x^2 - 81}{3x^2 + 19x - 72}$ (3)

f) $\frac{9x^2 - 100}{3x^2 + 28x + 60}$ (3)

2 Simplify fully:

a) $\frac{5x + 2}{4} + \frac{2x}{3}$ (3)

b) $\frac{6}{x + 1} \div \frac{3}{x - 4}$ (3)

c) $\frac{4}{x - 5} - \frac{x + 6}{x^2 - 2x - 15}$ (3)

3 a) Factorise $4x^2 - 1$. (1)

b) Hence express as a product of its prime factors:

i) 399

ii) 3.99×10^4 (4)

(Total 5 marks)

4 Solve:

a) $9x^2 - 16 = 0$ (2)

b) $5x^2 + 23x - 10 = 0$ (3)

c) $15x^2 + 5 = 28x$ (3)

(Total 8 marks)

5 Solve the equations and give your answers to 3 significant figures:

a) $2x^2 - 2x - 1 = 0$ (3)

b) $5x^2 - 7x + 11 = 0$ (3)

(Total 6 marks)

6 Solve the equations by completing the square:

a) $x^2 - 4x - 5 = 0$ (3)

b) $x^2 + 20x + 3 = 0$ (3)

7 Solve the simultaneous equations:

a) $y = x^2 - 5x + 7$

$$y = 2x + 1$$

(6)

b) $y^2 + x^2 = 20$

$$y = 3x - 10$$

(7)

c) $y^2 + x^2 = 5$

$3y = x + 5$

(7)

(Total 20 marks)

8 Solve:

$$\frac{2}{5-x} + \frac{3}{x+7} = 1$$

(Total 4 marks)

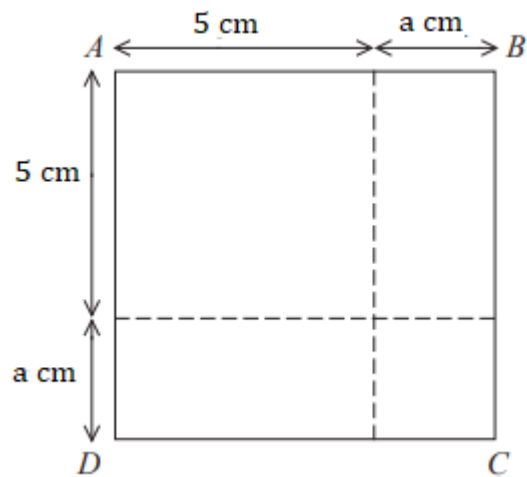
9 Given that $x^2 + 10x - 7 = (x - a)^2 - b$ for all values of x ,

a) Find the values of a and b . (2)

b) Hence write down the coordinates of the turning point on the graph

$y = x^2 + 10x - 7$. (1)

10



The area of the square ABCD is 40 cm^2 .

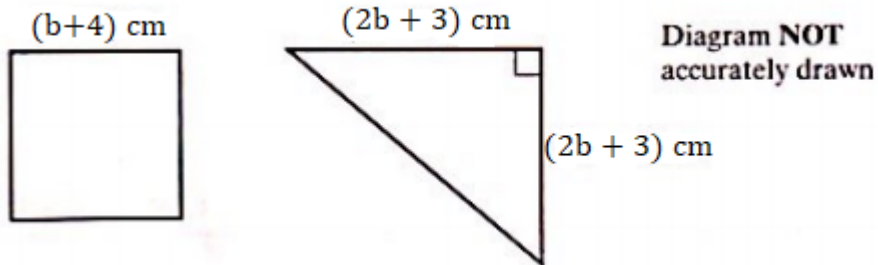
Show that $a^2 + 10x = 15$

(Total 3 marks)

11 A square has sides of length $(b + 4) \text{ cm}$.

A right-angled isosceles triangle has its two equal sides of length $(2b + 3) \text{ cm}$.

The area of the square is equal to the area of the triangle.



a) Write down an equation in b . (1)

b) Show that the equation simplifies to $2b^2 - 4b - 23 = 0$ (2)

c) By solving the equation $2b^2 - 4b - 23 = 0$, find the perimeter of the square.
Give your answer correct to 3 significant figures. (4)

Lesson Fundamentals

- Add/Subtract algebraic fractions — you must have the same denominator (exactly like the “normal” fractions)
- To simplify fractions — factorise and cancel the common terms on the numerator and denominator.
- Difference of two squares (DOTS):

$$x^2 - y^2 = (x - y)(x + y)$$

- To solve a quadratic equation — **always** make it equal to zero!! After that, you can solve it by factorising (quadratic formula or by completing the square).

$$ax^2 + bx + c = 0$$

TIPS:

- if the exam asks you to solve a quadratic but **do not** state any requirement for the rounding, usually that means it is possible to factorise.

- If the exam asks you to solve a quadratic but they **do** ask for a specific rounding, it's likely you'll need to use the quadratic formula.

- if you have a calculator and you cannot factorise a quadratic, use the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- If the exam requires to express a quadratic in this format $(x - a)^2 - b$ that means you **MUST** use "completing the square":

$$\left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2 + c$$

- To solve simultaneous equations with a quadratic you need to use substitution.

TIP: Remember to make one of the variables the subject and try to pick the easiest one for your calculations.

$y = 2x^2 + 8x - 3$
 $2y = 4x + 18$
 $y = \frac{4x + 18}{2} \Leftrightarrow y = \boxed{2x + 9}$
 substitute