

ALGEBRAIC FRACTIONS: EQUATIONS

GRADE 8

Examination Practice Questions

You should have:

A ruler, protractor, compasses, a pen, pencil, eraser, calculator.
For some questions, you may need tracing paper.

Instructions

- Use **black** ink or ball-point pen.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used.**

Information

- The marks for each question are shown in brackets.
- Use the number of marks for each question as a guide as to how much time to spend on each question. As a rough guide, you can multiply the number of marks by 1.2 to see how many minutes you should spend on a question.
- Questions been carefully compiled from or modelled on a variety of past papers and will generally get more challenging as the document progresses. Some of the later questions will go beyond the core grade level for this topic.

Advice

- Read each question carefully before you start to answer it.
- Don't forget to have fun.
- Check your answers at the end.

Solve the equation:

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

Give your answers correct to 2 decimal places.

$$(x+3)(7x+1) = (1)(5x+2) \quad (B_1)$$

$$7x^2 + x + 21x + 3 = 5x + 2 \quad (B_1)$$

$$7x^2 + 17x + 1 = 0 \quad (B_1)$$

$$x = \frac{-17 \pm \sqrt{17^2 - (4 \times 7 \times 1)}}{2 \times 7} \quad (M_1)$$

$$x = -0.06 \quad 2 \text{ d.p.}$$

$$x = -2.37 \quad (A_1)$$

Solve the equation:

$$\frac{5}{x+2} = \frac{4-3x}{x-1}$$

Give your answers correct to 2 decimal places.

$$(5)(x-1) = (4-3x)(x+2) \quad (M_1)$$

$$5x - 5 = 4x + 8 - 3x^2 - 6x \quad (M_1)$$

$$3x^2 + 7x - 13 = 0 \quad (A_1)$$

$$x = \frac{-7 \pm \sqrt{7^2 - (4 \times 3 \times -13)}}{2 \times 3} \quad (M_1)$$

$$\begin{aligned} x &= 1.22 \\ x &= -3.55 \end{aligned} \quad \left. \vphantom{\begin{aligned} x &= 1.22 \\ x &= -3.55 \end{aligned}} \right\} \text{2 d.p.}$$

(A₁)

Solve the equation:

$$\frac{5}{y-2} + \frac{3}{y+4} = 2$$

$$\frac{5(y+4) + 3(y-2)}{(y-2)(y+4)} = 2 \quad (M_1)$$

$$\frac{5y+20+3y-6}{y^2+4y-2y-8} = 2$$

$$5y+20+3y-6 = 2(y^2+2y-8) \quad (M_1)$$

$$5y+20+3y-6 = 2y^2+4y-16$$

$$2y^2 - 4y - 30 = 0 \quad (M_1)$$

$$y^2 - 2y - 15 = 0$$

$$(y+3)(y-5) = 0 \quad (A_1)$$

(4 marks)

$$\therefore y = -3 \quad y = 5$$

Solve the equation:

$$\frac{3}{x+2} + \frac{5}{x-4} = 2$$

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

(M₁)

$$3x - 12 + 5x + 10 = 2(x+2)(x-4)$$
$$8x - 2 = 2x^2 - 4x - 16$$

(M₁)

$$(M_1) \quad 2x^2 - 12x - 14 = 0 \quad (x^2 - 6x - 7 = 0)$$
$$(x-7)(x+1) = 0$$
$$x = 7 \quad x = -1$$

(A₁)

Solve the equation:

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

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

(M1)

(M1)

$$3x - 3 + 2x - 4 = 5(x-2)(x-1)$$

$$5x - 7 = 5x^2 - 15x - 10$$

(M1)

$$5x^2 - 20x + 17 = 0$$

(M1)

$$x = \frac{-(-20) \pm \sqrt{(-20)^2 - 4 \times 5 \times 17}}{2 \times 5}$$

(M1)

$$x = 1.23$$

$$x = 2.77$$

(A1)

Find the exact solutions of

$$x + \frac{3}{x} = 7$$

x by x

$$x^2 + 3 = 7x \quad (M1)$$

$$x^2 - 7x + 3 = 0$$

$$x = \frac{-7 \pm \sqrt{(-7)^2 - 4 \times 3}}{2 \times 1} \quad (M1)$$

$$x = \frac{7 + \sqrt{37}}{2}$$

$$x = \frac{7 - \sqrt{37}}{2}$$

(A1)

Find the exact solutions of

$$2x - \frac{12}{x} = 0$$

x by x

$$2x^2 - 12 = 0$$

M1

$$2x^2 = 12$$

$$x^2 = 6$$

M1

$$x = \pm \sqrt{6}$$

A1

Solve the equation:

$$\frac{4}{2x+1} + \frac{1}{4x^2-1} = 3$$

$$\frac{4(4x^2-1) + 1(2x+1)}{(2x+1)(4x-1)} = 3$$

M1

$$16x^2 - 4 + 2x + 1 = 3(2x+1)(4x-1)$$

M1

$$16x^2 + 2x - 3 = (6x+3)(4x-1)$$

$$16x^2 + 2x - 3 = 24x^2 - 6x + 12x - 3$$

$$+6x$$

M1

$$8x^2 + 4x = 0$$

$$x(8x+4) = 0$$

$$x = 0 \quad x = -\frac{1}{2}$$

A1

Solve the equation:

$$\frac{5}{x+2} + \frac{3}{x^2+2x} = 2$$

M1

$$\frac{5x}{x^2+2x} + \frac{3}{x^2+2x} = 2$$

$$\frac{5x+3}{x^2+2x} = 2$$

M1

$$5x+3 = 2(x^2+2x)$$

$$5x+3 = 2x^2+4x$$

$$2x^2 - x - 3 = 0$$

M1

$$x = -1$$

M1

QUADRATIC FORMULA

$$x = 1.5$$

A1

Solve the equation:

$$\frac{x}{2x-3} + \frac{4}{x+1} = 1$$

$$\frac{x(x+1) + 4(2x-3)}{(2x-3)(x+1)} = 1 \quad \text{M}_1$$

$$x^2 + x + 8x - 12 = 1(2x-3)(x+1) \quad \text{M}_1$$

$$x^2 + 9x - 12 = \cancel{2x^2} + 2x - 3x - 3 \quad \text{M}_1$$

$$x^2 - 10x + 9 = 0 \quad \text{M}_1$$

$$(x-1)(x-9) = 0 \quad \text{M}_1$$

$$x=1 \quad x=9 \quad \text{A}_1$$

Solve the equation:

$$\frac{3}{(x+1)} + \frac{2}{(2x-3)} = 1$$

$$\frac{3(2x-3) + 2(x+1)}{(x+1)(2x-3)} = 1 \quad M_1$$

$$6x - 9 + 2x + 2 = 1(x+1)(2x-3) \quad M_1$$

$$8x - 7 = 2x^2 - x - 3$$

$$2x^2 - 9x + 4 = 0 \quad M_1$$

-9 8

$$2x^2 - 1x - 8x + 4 = 0$$

$$x(2x-1) - 4(2x-1) = 0$$

$$(x-4)(2x-1) = 0 \quad M_1$$

$$x = 4 \quad x = \frac{1}{2} \quad A_1$$

(5 marks)

Solve the equation

$$\frac{6}{x+3} + \frac{1}{2x+5} = 3$$

Give your answer to 2 decimal places.

$$6(2x+5) + 1(\underbrace{x+3}_{M1}) = 3(x+3)(2x+5)$$

$$12x + 30 + x + 3 = 3(2x^2 + 11x + 15) \quad (M1)$$

$$13x + 33 = 6x^2 + 33x + 45$$

$$6x^2 + 20x + 12 = 0 \quad (A1)$$

$$3x^2 + 10x + 6 = 0$$

$$x = \frac{-10 \pm \sqrt{10^2 - 4 \times 3 \times 6}}{2 \times 3} \quad (M1)$$

$$(A1) \text{ IF CORRECT}$$

$$x = -0.78 \quad x = -2.55$$

$$(A1)$$

(6 marks)

Solve the equation:

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

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

M1

$$\frac{2x+2-2x+6}{(x-3)(x+1)} = \frac{3}{x+5}$$

$$8(x+5) = 3(x-3)(x+1)$$

M1

$$8x+40 = 3x^2-6x-9$$

$$3x^2-14x-49=0$$

A1

$$(3x+7)(x-7)=0$$

M1

$$x=7 \quad x=-7/3$$

A1

(5 marks)

Solve the equation:

$$\frac{5x+4}{x+4} - \frac{3x-4}{2x+1} = 2$$

$$\frac{(5x+4)(2x+1) - (3x-4)(x+4)}{(x+4)(2x+1)} = 2$$

M1

$$\frac{10x^2 + 13x + 4 - (3x^2 + 8x - 16)}{2x^2 + 9x + 4} = 2$$

M1

$$7x^2 + 5x + 20 = 4x^2 + 18x + 8$$

$$3x^2 - 13x + 12 = 0$$

M1

$$(3x-4)(x-3) = 0$$

M1

$$x = \frac{4}{3} \quad x = 3$$

A1

(5 marks)

Solve the equation:

$$\frac{3}{2x+3} - \frac{1}{2x-3} + \frac{6}{\cancel{4x^2-9}} = 1$$

$$(2x+3)(2x-3)$$

B,

$$\frac{3(2x-3) - 1(2x+3) + 6}{(2x+3)(2x-3)} = 1$$

M1

$$\frac{4x-6}{(2x+3)(2x-3)} = 1$$

M1

$$\frac{2(\cancel{2x-3})}{(2x+3)(\cancel{2x-3})} = 1$$

M1

$$2 = 2x + 3$$

M1

$$-1 = 2x$$

$$x = -\frac{1}{2}$$

A1

(6 marks)

The line joining $(a, 7)$ to $(-1, 10)$ is perpendicular to the line joining $(a, 7)$ to $(9, -6)$.

Find the possible values of a .

GRADIENTS :

$$\frac{10-7}{-1-a} \times \frac{-6-7}{9-a} = -1$$

$$3 \times -13 = -1(-1-a)(9-a)$$

$$39 = a^2 - 8a - 9$$

$$a^2 - 8a - 48 = 0$$

$$a = 12 \quad a = -4$$

Given that

$$2x - 1 : x - 4 = 16x + 1 : 2x - 1$$

find the possible values of x .

$$\frac{2x-1}{x-4} = \frac{16x+1}{2x-1} \quad (P_1)$$

$$(2x-1)^2 = (16x+1)(x-4) \quad (P_1)$$

$$12x^2 - 59x - 5 = 0 \quad (P_1)$$

$$(12x+1)(x-5) = 0 \quad (P_1)$$

$$x = 5 \quad x = -\frac{1}{12} \quad (A_1)$$

In a race, Akaash ran a distance of $8x^2 - 105$ metres in $6x + 1$ seconds.

His average speed for the race was $x \text{ ms}^{-1}$.

Calculate the distance, in metres, that Akaash ran in the race. Show clear algebraic working.

$$x = \frac{8x^2 - 105}{6x + 1} \quad \left(s = \frac{D}{T} \right)$$

m_1

$$x(6x + 1) = 8x^2 - 105$$

$$2x^2 - x - 105 = 0 \quad m_1$$

$$(2x - 15)(x + 7) = 0 \quad m_1$$

$$\cancel{x = -7} \quad x = 7.5 \quad m_1$$

$$8(7.5)^2 - 105 = \underline{\underline{345 \text{ m}}} \quad A_1$$

m_1

NOT POSSIBLE