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GCSE MATHS

Algebra

Edexcel 1MA1 | Subtopic collection Topic 14

Algebraic fractions

Higher tier

Past paper question booklet

53	2003-2024	Higher
question groups	available papers	tier

Before you begin

1. Show working and use units where appropriate.
2. Use extra paper if you need more space.
3. Print at actual size (100%) for measurement questions.

Name _____ **Date** _____

Whole questions are retained for context; some parts cover other points. Legacy sources are labelled.

11. The fraction, p, of an adult's dose of medicine which should be given to a child who weighs w kg is given by the formula

$$p = \frac{3w + 20}{200}$$

(a) Use the formula $p = \frac{3w + 20}{200}$ to find the weight of a child whose dose is the same as an adult's dose.

..... kg
(3)

(b) Make w the subject of the formula $p = \frac{3w + 20}{200}$

$w =$ .....
(3)

$$\frac{3w + 20}{200} = \frac{A}{A + 12}$$

(c) Express A in terms of w.

$A =$ .....
(4)

17. (a) Factorise

$$9x^2 - 6x + 1$$

.....

(2)

(b) Simplify

$$\frac{6x^2 + 7x - 3}{9x^2 - 6x + 1}$$

.....

(3)

6. (a) Simplify $a^3 \times a^4$

.....
(1)

(b) Simplify $3x^2y \times 5xy^3$

.....
(2)

(c) Simplify $\dfrac{(x-1)^2}{x-1}$

.....
(1)

(d) Factorise $a^2 - 9b^2$

.....
(2)

(Total 6 marks)

Q6

18. Simplify fully

(a) $(3xy^2)^4$

.....

(2)

(b) $\dfrac{x^2-3x}{x^2-8x+15}$

.....

(3)

(Total 5 marks)

Q18

Blank

21. (a) Expand $x(3 - 2x^2)$

.....

(2)

(b) Factorise completely $12xy + 4x^2$

.....

(2)

(c) Simplify $\dfrac{20a^2}{4ab^2}$

.....

(2)

(d) Simplify $\dfrac{x-3}{x^2-9}$

.....

(2)

Q21

(Total 8 marks)

Question 06

25. Simplify fully $\dfrac{x^2-8x+15}{2x^2-7x-15}$

blank

.....

(Total 3 marks)

Q25

Blank

16. (a) Expand and simplify $3(x + 5) + 2(5x - 6)$

.....

(2)

(b) Simplify $\frac{2x+4}{2}$

.....

(1)

(c) Factorise $5x + 10$

.....

(1)

(d) Factorise fully $x^2y + xy^2$

.....

(2)

Q16

(Total 6 marks)

25. (a) Expand and simplify $(2x + 4y)(4x - 5y)$

.....

(2)

(b) Simplify fully $\dfrac{(x+10)^5}{(x+10)^4}$

.....

(1)

(c) Simplify fully $\dfrac{x^2-25}{x^2+7x+10}$

.....

(3)

For all values of x, $x^2 + 6x - 2 = (x + p)^2 + q$

(d) Find the value of p and the value of q.

$p =$ ..... $q =$ .....

(2)

Q25

(Total 8 marks)

15 Write as a single fraction in its simplest form

$$\frac{2x}{x-1} - \frac{7x-3}{x^2-1}$$

.....

(Total for Question 15 is 4 marks)

14 Simplify fully $\dfrac{x^2-2x-15}{x^2-4x-21}$

.....

(Total for Question 14 is 3 marks)

16 (a) Simplify $\dfrac{2y-12}{y^2-8y+12}$

.....

(3)

(b) Write as a single fraction $\dfrac{3}{x-4}-\dfrac{1}{x+5}$

.....

(2)

(Total for Question 16 is 5 marks)

19. Find the exact solutions of $x + \frac{3}{x} = 7$

.....

Q19

(Total 3 marks)

23. (a) Factorise $x^2 + px + qx + pq$

.....

(2)

(b) Factorise $m^2 - 4$

.....

(1)

(c) Write as a single fraction in its simplest form $\frac{2}{x-4} - \frac{1}{x+3}$

.....

(3)

(Total 6 marks)

Q23

17 Write $\frac{3}{b} + \frac{2}{a-b}$ as a single fraction in its simplest form.

.....

(Total for Question 17 is 3 marks)

23 (a) Simplify fully $\dfrac{x^2 + 3x - 4}{2x^2 - 5x + 3}$

.....

(3)

(b) Write $\dfrac{4}{x+2} + \dfrac{3}{x-2}$ as a single fraction in its simplest form.

.....

(3)

(Total for Question 23 is 6 marks)

18 Simplify completely $\dfrac{2x^2 - 9x - 5}{4x^3 + 2x^2}$

.....

(Total for Question 18 is 3 marks)

20 Simplify $\frac{x+1}{2} + \frac{x+3}{3}$

.....

(Total for Question 20 is 3 marks)

14 (a) Factorise $x^2 + 5x + 4$

.....

(2)

(b) Expand and simplify $(3x - 1)(2x + 5)$

.....

(2)

(c) Write as a single fraction $\frac{1}{2x} + \frac{1}{5x} - \frac{1}{3x}$

.....

(2)

(Total for Question 14 is 6 marks)

Question 19

17 Simplify $\dfrac{x^2 - 3x}{2x^2 - 5x - 3}$

.....

(Total for Question 17 is 3 marks)

23 Simplify $\dfrac{4(x+5)}{x^2+2x-15}$

.....

(Total for Question 23 is 2 marks)

18 Simplify fully $\dfrac{2x^2 + 6x}{x^2 - 2x - 15}$

.....

(Total for Question 18 is 3 marks)

20 (a) Solve $\frac{4(8x - 2)}{3x} = 10$

.....

(3)

(b) Write as a single fraction in its simplest form

$$\frac{2}{y + 3} - \frac{1}{y - 6}$$

.....

(3)

(Total for Question 20 is 6 marks)

22 (a) Simplify $(3x^2y^4)^3$

.....

(2)

(b) Simplify $\dfrac{x^2 - 9}{2x^2 + 5x - 3}$

.....

(3)

(Total for Question 22 is 5 marks)

18 Simplify fully $\dfrac{3x^2 - 6x}{x^2 + 2x - 8}$

.....

(Total for Question 18 is 3 marks)

22 (a) Simplify fully $(3e)^0$

.....

(1)

(b) Simplify fully $\left(\frac{64x^6}{25y^2}\right)^{-\frac{1}{2}}$

.....

(2)

(c) Write $\frac{5}{x-3} - \frac{4}{x+3}$ as a single fraction in its simplest form.

.....

(3)

(Total for Question 22 is 6 marks)

13 Simplify fully $\frac{4}{2-x} - \frac{3}{x}$

.....

(Total for Question 13 is 3 marks)

21 (a) Write as a single fraction in its simplest form $\frac{5}{2-x} - \frac{4}{x}$

.....

(3)

(b) Make y the subject of the formula

$$t = \frac{2-3y}{y+2}$$

.....

(4)

(Total for Question 21 is 7 marks)

17 Simplify fully $\dfrac{x^2 - 2x - 15}{2x^2 + 7x + 3}$

.....

(Total for Question 17 is 3 marks)

24 (a) Simplify fully $\dfrac{3-x}{3x^2-5x-12}$

.....

(2)

(b) Write $\dfrac{x}{x-1}-\dfrac{x}{x+1}$ as a single fraction in its simplest form.

.....

(3)

(Total for Question 24 is 5 marks)

Question 30

17 Simplify fully $\dfrac{2x^2+5x-3}{x^2-9}$

.....

(Total for Question 17 is 3 marks)

***24** Prove that, for all positive values of n,

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

(Total for Question 24 is 4 marks)

Question 32

15 Simplify fully $\dfrac{7x^2 - 21x}{x^2 + 2x - 15}$

.....

(Total for Question 15 is 3 marks)

19 (a) Solve $x^2 + 2x - 35 = 0$

.....

(3)

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

Give your solutions as surds.

.....

(4)

(Total for Question 19 is 7 marks)

17 (a) Simplify $\dfrac{3(x+1)}{(x+1)^2}$

.....

(1)

(b) Solve $\dfrac{15-x}{5} = 3x + 11$

$x =$ .....

(3)

(c) Make m the subject of the formula $v = \sqrt{\dfrac{2E}{m}}$

.....

(3)

(Total for Question 17 is 7 marks)

Question 35

June 2017 | 1MA1/2H | Original Q19

19 $2 - \dfrac{x+2}{x-3} - \dfrac{x-6}{x+3}$ can be written as a single fraction in the form $\dfrac{ax+b}{x^2-9}$ where a and b are integers.

Work out the value of a and the value of b.

$a =$ .....

$b =$ .....

(Total for Question 19 is 4 marks)

Question 36

June 2018 | 1MA1/1H | Original Q17

17 Simplify fully $\dfrac{3x^2 - 8x - 3}{2x^2 - 6x}$

.....

(Total for Question 17 is 3 marks)

Question 37

November 2018 | 1MA1/1H | Original Q10

10 (a) Simplify $\dfrac{x-1}{5(x-1)^2}$

.....

(1)

(b) Factorise fully $50 - 2y^2$

.....

(2)

(Total for Question 10 is 3 marks)

12 (a) Write $\frac{4x^2 - 9}{6x + 9} \times \frac{2x}{x^2 - 3x}$ in the form $\frac{ax + b}{cx + d}$ where a, b, c and d are integers.

.....

(3)

(b) Express $\frac{3}{x+1} + \frac{1}{x-2} - \frac{4}{x}$ as a single fraction in its simplest form.

.....

(3)

(Total for Question 12 is 6 marks)

Question 39

13 Show that $6 + \left[(x + 5) \div \frac{x^2 + 3x - 10}{x - 1} \right]$ simplifies to $\frac{ax - b}{cx - d}$ where a, b, c and d are integers.

(Total for Question 13 is 4 marks)

Question 40

November 2019 | 1MA1/1H | Original Q13

13 (a) Write $\frac{5}{x+1} + \frac{2}{3x}$ as a single fraction in its simplest form.

.....

(2)

(b) Factorise $(x + y)^2 + 3(x + y)$

.....

(1)

(Total for Question 13 is 3 marks)

22 Show that $\dfrac{7x-14}{x^2+4x-12} \div \dfrac{x-6}{x^3-36x}$ simplifies to ax where a is an integer.

(Total for Question 22 is 4 marks)

12 (a) Express $\frac{x}{x+2} + \frac{2x}{x-4}$ as a single fraction in its simplest form.

.....

(3)

(b) Expand and simplify $(x - 3)(2x + 3)(4x + 5)$

.....

(3)

(Total for Question 12 is 6 marks)

Question 43

15 Show that $\frac{4x+3}{2x}+\frac{3}{5}$ can be written in the form $\frac{ax+b}{cx}$ where a, b and c are integers.

(Total for Question 15 is 3 marks)

Question 44

22 Show that $\frac{6x^3}{(9x^2 - 144)} \div \frac{2x^4}{3(x - 4)}$ can be written in the form $\frac{1}{x(x + r)}$ where r is an integer.

(Total for Question 22 is 3 marks)

Question 45

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

Give your answer in the form $\frac{p\pm\sqrt{q}}{2}$ where p and q are integers.

.....

(Total for Question 19 is 4 marks)

Question 46

19 Show that $\frac{3x}{x+2} - \frac{2x+1}{x-2} - 1$ can be written in the form $\frac{ax+b}{x^2-4}$ where a and b are integers.

(Total for Question 19 is 4 marks)

19 Solve $\frac{1}{x} - \frac{1}{x+1} = 4$

Give your answer in the form $a \pm b\sqrt{2}$ where a and b are fractions.

.....

(Total for Question 19 is 5 marks)

Question 48

22 $\frac{2x+3}{x-5} + \frac{x-4}{x+5} - 3$ can be written in the form $\frac{ax+b}{x^2-25}$ where a and b are integers.

Work out the value of a and the value of b.
You must show all your working.

a = ...

b = ...

(Total for Question 22 is 3 marks)

Question 49

14 Show that $\frac{x^2 - x - 6}{2x^2 - 5x - 3}$ can be written in the form $\frac{ax + b}{cx + d}$ where a, b, c and d are integers.

(Total for Question 14 is 3 marks)

24 There is a total of y counters in a box.

There are x pink counters and 5 blue counters in the box.
The rest of the counters are green.

$$x : y = 1 : 3$$

Freda takes at random two counters from the box.

Find, in terms of x, an expression for the probability that Freda takes two counters of the same colour.

Give your answer as a fraction in the form $\frac{ax^2 + bx + c}{dx^2 + ex}$ where a, b, c, d and e are integers.

.....

(Total for Question 24 is 5 marks)

20 Write

$$\frac{14}{3x-21}+\left[(x+4)\div\frac{2x^2-6x-56}{2x+3}\right]$$ in the form $\frac{ax+b}{cx+d}$ where a, b, c and d are integers.

.....

(Total for Question 20 is 4 marks)

Question 52

June 2024 | 1MA1/3H | Original Q15

15 (a) Simplify fully $\dfrac{(a-3)^2}{5(a-3)}$

.....

(1)

(b) Factorise $3k^2 + 11k - 4$

.....

(2)

(c) Simplify fully $\dfrac{4-x^2}{x^2+3x} \div \dfrac{x+2}{x+3}$

.....

(3)

(Total for Question 15 is 6 marks)

Question 53

17 Show that $\frac{6x - y}{10xy} + \frac{1}{2x} - \frac{2y - 7x}{5xy}$ simplifies to $\frac{k}{y}$ where k is an integer.

(Total for Question 17 is 3 marks)