



St. Patrick's High School, Keady
Mathematics Department

GCSE Mathematics Practice Booklet

M4

Topic 2 – Algebra 1

The Language of Algebra

Expressions

Equations

Algebraic Fractions

Questions taken from CCEA Past Papers
Mark Scheme included at the end of this booklet



Q1 Factorise fully each of the following:

(a) $12a + 6$

Answer _____ [1]

(b) $y^2 - 6y$

Answer _____ [1]

(c) $b + b^2$

Answer _____ [1]

Q2 Expand and simplify

$$4(2x - 3) - 2(x - 5)$$

Answer _____ [2]

Q3

Expand and simplify $2y(3y - 7) - 8y$

Answer _____ [3]

Q4

Solve $4 + 3(2x - 5) = x + 9$

Answer $x =$ _____ [3]

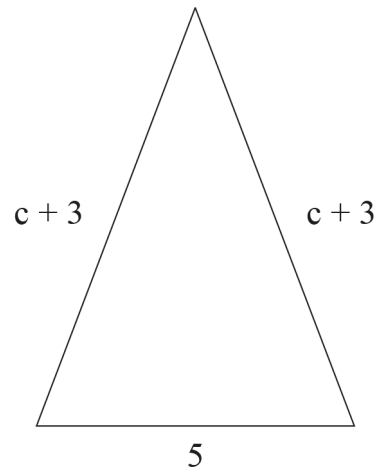
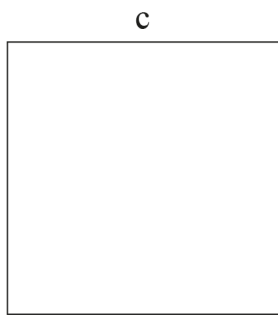
Q5

Solve $5(3x - 2) = 7x + 4$

Answer $x =$ _____ [3]

Q6

The diagrams below show a square and an isosceles triangle.



diagrams
not drawn
accurately

They have the same perimeter.

By forming and solving an equation, work out the perimeter.

Answer _____ [4]

Q7

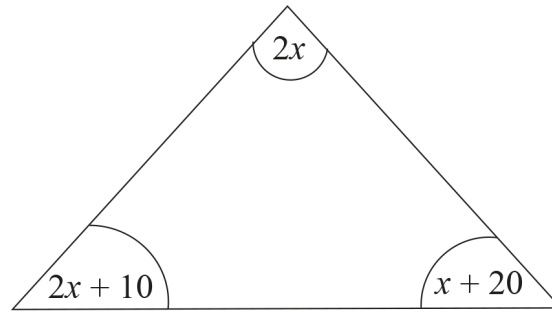


diagram
not drawn
accurately

Form and solve an equation to work out the size of the smallest angle in the triangle above.

Equation _____ [1]

Answer smallest angle = _____° [3]

Q8

(a) Simplify

$$5(t - 2) - 3(4 - 2t)$$

Answer _____ [2]

(b) Expand and simplify $(e + 4)(e - 7)$.

Answer _____ [2]

Q9

(a) Expand and simplify $3(4x + 3)(2x - 1)$

Answer _____ [3]

(b) Factorise $t^2 - 49$

Answer _____ [1]

Q10

Factorise fully $14x^2y - 35x$

Answer _____ [2]

Q11

(a) Expand $(3x - y)^2$

Answer _____ [2]

(b) Factorise $x^2 - 25$

Answer _____ [1]

Q12 Expand and simplify $(3w - 7)(5w - 8)$

Answer _____ [2]

Q13 (a) Factorise

(i) $6a + 15$

Answer _____ [1]

(ii) $4x - x^2$

Answer _____ [1]

(b) Solve $6x - 7 = 14 - x$

Answer $x =$ _____ [3]

(c) Simplify $\frac{y}{3} - \frac{y}{5}$

Answer _____ [2]

Q14

Factorise each of the following.

(a) $10cp^2 - 4cp$

Answer _____ [2]

(b) $y^2 - 1$

Answer _____ [1]

(c) $k^2 - 2k - 3$

Answer _____ [2]

(d) $(x - 2)^2 + 5(x - 2)$

Answer _____ [2]

Q15

Factorise $y^2 - 6y + 8$

Answer _____ [2]

Q16

Expand and simplify $(p - 6)(p + 2)$

Answer _____ [2]

Q17

Factorise

(a) $p^2 - 3p$

Answer _____ [1]

(b) $100 - t^2$

Answer _____ [1]

(c) $x^2 + 2x - 15$

Answer _____ [2]

Q18

(a) Expand and simplify

$$(2x - 5)(3x + 2)$$

Answer _____ [3]

(b) Simplify

$$\frac{x^2 - 49}{2x - 14}$$

Answer _____ [2]

Q19

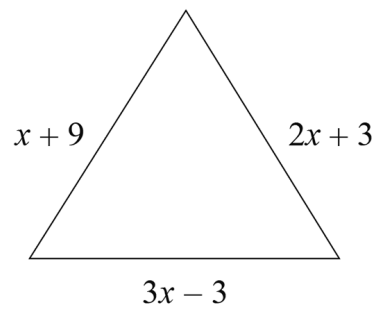
(a) Factorise $x^2 + 2x - 35$

Answer _____ [2]

(b) Hence, or otherwise, solve the equation $x^2 + 2x = 35$

Answer $x =$ _____ [1]

Q20



The diagram shows an equilateral triangle.

Form and solve an equation to calculate the **perimeter** of the triangle.

Equation _____ [1]

Answer perimeter = _____ [3]

Q21

Solve the equation $\frac{2x+3}{4} + \frac{x-1}{3} = 5$
Show all your work.

Answer $x =$ _____ [4]

Q22

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

Answer $x =$ _____ [4]

Q23

Solve

$$\frac{a-1}{4} + \frac{a+1}{8} = \frac{3}{2}$$

Give your answer as a mixed number.

Answer $a =$ _____ [4]

Q24

Solve $\frac{2x-1}{5} + \frac{4x+5}{3} = \frac{20}{3}$

A solution by trial and improvement will not be accepted.

Answer _____ [4]

Q25

Mary and Anne both go to a shop, each with the same amount of money.

Mary buys 7 bars of chocolate at y pence each and receives 19p change.

Anne buys 5 bars of chocolate at y pence each and receives 65p change.

By forming and solving an equation, work out how much money each girl had going to the shop.

You must show all your working.

A solution by trial and improvement will not be accepted.

Equation _____ [1]

Answer: Each girl had _____ going to the shop. [3]

Q26

Solve $\frac{1}{4}(y + 3) - 2 = \frac{1}{2}(3 - 2y)$

Answer $y =$ _____ [4]

Q27

Simplify $\frac{5t}{6} - \frac{t}{2}$

Answer _____ [3]

Q28

Solve the equation

$$\frac{2x-1}{3} + \frac{x+2}{2} + \frac{x}{6} = 8$$

Show all your working clearly.

A solution by trial and improvement will not be accepted.

Answer $x =$ _____ [5]

Q29

Solve the equation $\frac{2(3x+2)}{5} - \frac{(3x-4)}{3} = \frac{2}{15}$

Show all your working out clearly.

A solution by trial and improvement will not be accepted.

Answer $x =$ _____ [4]

Q30

Simplify $\frac{x^2 - 2x}{3} \times \frac{6}{x^2 + 2x - 8}$

Answer _____ [3]

Q31

Simplify $5 - \frac{x+10}{2}$

Answer _____ [2]

Q32

Simplify $\frac{x^3 - 3x^2}{x^2 - 9}$

Answer _____ [3]

Q33

Factorise fully

$$100ax^2 + 65axy - 75ay^2$$

Answer _____ [3]

Q34 (a) Expand and simplify $(5x + 2)(4x - 3)$

Answer _____ [2]

(b) Simplify $\frac{x^2 + 4x}{x^2 - 16}$

Answer _____ [3]

(c) Factorise $8ax^2 - 26axy + 15ay^2$

Answer _____ [3]

Q35

Factorise $6x^2 - 17xy + 12y^2$

Answer _____ [2]

Q36

Simplify $\frac{6a^2 + 4a - 16}{8 - 2a^2}$

Answer _____ [3]

Q37

(a) Factorise fully

$$30ax^2 + 5axy - 60ay^2$$

Answer _____ [3]

(b) Using your answer from above and given that $a \neq 0$ solve

$$30ax^2 + 5axy - 60ay^2 = 0$$

to find two answers for x in terms of y .

Answers $x =$ _____ , $x =$ _____ [2]

Q38

Simplify fully

$$\frac{3x^2 - 6xy}{4x^2 - 8xy - 3xy + 6y^2}$$

Answer _____ [2]

Q39

Factorise $15x^2 + 2xy - 8y^2$

Answer _____ [2]

Q40 Factorise fully $8x^2 - 50y^2$

Answer _____ [3]

Q41

(a) Factorise $2a^2 + 7ab - 4b^2$

Answer _____ [2]

(b) Simplify the following

$$\left(\frac{x+1}{2x-1} + \frac{3x-4}{x-4} \right) \times \frac{2x-1}{x}$$

Answer _____ [4]

Q42

Solve the equation

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

Answer _____ [6]

Q43 A group of p people were asked their ages in years.

The total of their ages was 960 years.

When 20 of the people were removed from the group the total of the ages of the remaining group was 480

Given that the mean of the original group was three-quarters of the mean of the remaining group, find the number of people in the original group.

Answer $p =$ _____ [3]

Q44 A group of men and women were asked to give their ages in complete years.
The total of the men's ages was 1000
The total of the women's ages was 900
There were 5 more women than men and the mean of the women's ages was 10 smaller than the mean of the men's ages.
Find the number of men.

Answer _____ [4]

Q45

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

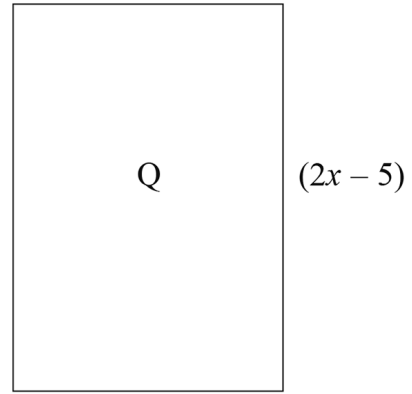
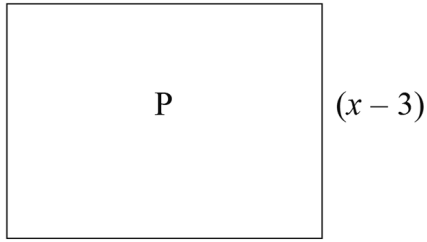
Show all your work.

A solution by trial and improvement will not be accepted.

Answer $x =$ _____ [6]

Q46

Two rectangles P and Q are shown.



The **width** of rectangle P is $(x - 3)$ cm and the **width** of Q is $(2x - 5)$ cm.

The area of rectangle P is 2 cm^2 and the area of rectangle Q is 3 cm^2 .

The sum of the lengths of the two rectangles is 3 cm.

By forming and solving an equation find the lengths of both rectangles.

Length of rectangle P _____ cm Length of rectangle Q _____ cm [7]

Q47

Solve the equation

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

Answer _____ [7]

Q48

Solve the following equation giving your answers to 2 decimal places.

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

Answer _____ [8]

Q49

Simplify

$$\left(\frac{1}{x+4} + \frac{1}{2x-3}\right) \div \frac{3x^2 - 11x - 4}{2x^2 - 32}$$

Answer _____ [6]

Q50 Given that $\frac{2}{x+a} - \frac{5}{x-a} = 1$ has a solution $x = 3$, find the possible values of a .

Answer _____ [6]

1. (a) $6(2a + 1)$ A1
(b) $y(y - 6)$ A1
(c) $b(1 + b)$ A1
-

2. $8x - 12 - 2x + 10$ MA1
 $= 6x - 2$ MA1
-

3. $6y^2 - 14y - 8y$ MA1 MA1
 $6y^2 - 22y$ MA1
-

4. $4 + 6x - 15 = x + 9$ MA1
 $6x - x = 9 - 4 + 15$
 $5x = 20$ MA1
 $x = 4$ MA1
-

5. $15x - 10 = 7x + 4$ MA1
 $15x - 7x = 4 + 10$
 $8x = 14$ MA1
 $x = \frac{14}{8}$ or $1\frac{3}{4}$ MA1

6. $4c = 2c + 11$ MA1
 $2c = 11$ MA1
 $c = 5.5$ A1
22 A1

7. $2x + 10 + 2x + x + 20 = 180$ M1
 $5x = 150$ MA1
 $x = 30$ MA1
Smallest angle = 50 A1

8. (a) $5t - 10 - 12 + 6t$ MA1
 $11t - 22$ A1
- (b) $e^2 - 7e + 4e - 28$ MA1
 $e^2 - 3e - 28$ A1
-

9. (a) $8x^2 + 6x - 4x - 3$ MA1
 $8x^2 + 2x - 3$ MA1
 $3(8x^2 + 2x - 3) = 24x^2 + 6x - 9$ MA1
- Alternative solution**
- $(12x + 9)(2x - 1)$ MA1
 $24x^2 + 18x - 12x - 9$ MA1
 $24x^2 + 6x - 9$ MA1
- (b) $(t - 7)(t + 7)$ MA1
-

10. $7x(2xy - 5)$ A2
(A1 for correct partial factorisation)
-

11. (a) $9x^2 - 6xy + y^2$ A2

(b) $(x - 5)(x + 5)$ A1

12. $15w^2 - 24w - 35w + 56$ M1

$15w^2 - 59w + 56$ A1

13. (a) (i) $3(2a + 5)$ A1

(ii) $x(4 - x)$ A1

(b) $6x + x = 14 + 7$ MA1

$7x = 21$ MA1

$x = 3$ A1

(c) $\frac{5y}{15} - \frac{3y}{15}$ A1

$= \frac{2y}{15}$ A1

14. (a) $2cp(5p - 2)$ A1 A1
- (b) $(y - 1)(y + 1)$ A1
- (c) $(k - 3)(k + 1)$ A2
- (d) $(x - 2)[(x - 2) + 5]$ A1
- $(x - 2)(x + 3)$ A1
- alternative solution**
- $(x - 2)(x - 2) + 5(x - 2) = x^2 - 4x + 4 + 5x - 10 = x^2 + x - 6$ A1
- $(x + 3)(x - 2)$ A1
-

15. $(y - 2)(y - 4)$ MA2
-

16. $p^2 - 6p + 2p - 12$ MA1
- $p^2 - 4p - 12$ A1
-

17. (a) $p(p - 3)$ A1
- (b) $(10 - t)(10 + t)$ A1
- (c) $(x + 5)(x - 3)$ A2
-

18. (a) $6x^2 + 4x - 15x - 10$ MA2
 $6x^2 - 11x - 10$ A1
- (b) $\frac{(x + 7)(x - 7)}{2(x - 7)}$ MA1
 $\frac{x + 7}{2}$ A1
-

19. (a) $(x + 7)(x - 5)$ MA2
- (b) $x = -7$ or 5 MA1
-

20. $x + 9 = 2x + 3$ or $x + 9 = 3x - 3$ or $2x + 3 = 3x - 3$ MA1
 appropriate equation solved to get $x = 6$ MA1
 side length = 15 MA1
 perimeter = 45 A1
-

21.	$3(2x + 3) + 4(x - 1) = 60$	M1
	$6x + 9 + 4x - 4 = 60$	MA1
	$10x = 55$	MA1
	$x = 5.5$ (or equivalent)	A1

22.	$6(x + 3) = 2(5x)$	MA1
	$6x + 18 = 10x$	MA1
	$18 = 4x$	MA1
	$x = 4\frac{1}{2}$	MA1

alternative solution

$\frac{x + 3}{2} - \frac{5x}{6} = 0$ ($\times 6$)	
$3(x + 3) - 5x = 0$	MA1
$3x + 9 - 5x = 0$	MA1
$9 = 2x$	MA1
$x = 4\frac{1}{2}$	A1

alternative solution

$\frac{3(x + 3)}{6} = \frac{5x}{6}$	MA1
$3x + 9 = 5x$	MA1
$9 = 2x$	MA1
$x = 4\frac{1}{2}$	MA1

23.	$2(a - 1) + (a + 1) = 12$	MA1
	$2a - 2 + a + 1 = 12$	MA1
	$3a = 13$	MA1
	$a = 4\frac{1}{3}$	MA1

24.	multiply by 15	$3(2x - 1) + 5(4x + 5) = 100$	MA1
		$6x - 3 + 20x + 25 = 100$	MA1
		$26x = 78$	MA1
		$x = 3$	A1

Alternative Solution:

	$\frac{3(2x - 1) + 5(4x + 5)}{15} = \frac{100}{15}$	MA1
	$6x - 3 + 20x + 25 = 100$	MA1
	$26x = 78$	MA1
	$x = 3$	A1

25.	$7y + 19 = 5y + 65$	MA1
	$2y = 46$	MA1
	$y = 23$	MA1
	$7 \times 23 + 19 = \text{£}1.80$ (or $5 \times 23 + 65 = \text{£}1.80$)	A1
	do not penalise money notation	

26. Multiplying by 4

$$y + 3 - 8 = 2(3 - 2y) \quad \text{MA1}$$

$$y + 3 - 8 = 6 - 4y \quad \text{MA1}$$

$$5y = 11 \quad \text{MA1}$$

$$y = \frac{11}{5} = 2 \frac{1}{5} \quad \text{MA1}$$

Alternative solution

$$\frac{1}{4}y + \frac{3}{4} - 2 = \frac{3}{2} - y \quad \text{MA1}$$

$$\frac{1}{4}y + y = \frac{3}{2} + 2 - \frac{3}{4} \quad \text{MA1}$$

$$\frac{5}{4}y = 2 \frac{3}{4} \quad \text{MA1}$$

$$y = 2 \frac{1}{5} \quad \text{MA1}$$

27. $\frac{5t - 3t}{6}$ (or equivalent fractions with different denominator) MA1

$$= \frac{2t}{6} \quad \text{A1}$$

$$= \frac{t}{3} \quad \text{A1}$$

28.	$\frac{2(2x-1) + 3(x+2) + x}{6} = 8$	MA1
	$\frac{4x-2 + 3x+6 + x}{6} = 8$	MA1
	$\frac{8x+4}{6} = 8$	MA1
	$8x = 44$	MA1
	$x = 5\frac{1}{2}$	A1

alternative solution

$2(2x-1) + 3(x+2) + x = 48$	MA2
$4x-2 + 3x+6 + x = 48$	MA1
$8x = 44$	MA1
$x = 5\frac{1}{2}$	A1

29.	$6(3x+2) - 5(3x-4) = 2$	MA1
	$18x+12 - 15x+20 = 2$	MA1
	$3x = -30$	MA1
	$x = -10$	A1

Alternative Solution:

$\frac{6x}{5} + \frac{4}{5} - x + \frac{4}{3} = \frac{2}{15}$	MA2
$\frac{x}{5} = -2$	MA1
$x = -10$	A1
follow for numerical errors, but not omission of key elements of method	

30. $\frac{x(x-2)}{3} \times \frac{6}{(x+4)(x-2)}$ MA2
 $= \frac{2x}{x+4}$ A1

31. $\frac{10-(x+10)}{2}$ MA1
 $= -\frac{x}{2}$ A1

Alternative solution

$5 - \frac{x}{2} - \frac{10}{2}$ MA1
 $= -\frac{x}{2}$ A1

32. $\frac{x^2(x-3)}{(x+3)(x-3)} = \frac{x^2}{x+3}$ MA1 MA1
MA1

33. $5a(20x^2 + 13xy - 15y^2)$ A1
 $= 5a(5x - 3y)(4x + 5y)$ A1 A1

34. (a) $20x^2 - 15x + 8x - 6$ MA1
 $20x^2 - 7x - 6$ MA1
- (b) $\frac{x(x+4)}{(x+4)(x-4)}$ MA1
MA1
- $\frac{x}{x-4}$ MA1
- (c) $a(8x^2 - 26xy + 15y^2)$ MA1
 $a(4x-3y)(2x-5y)$ MA2
-

35. $(3x-4y)(2x-3y)$ MA2
-

36. $\frac{2(3a-4)(a+2)}{2(2-a)(2+a)}$ MA1
MA1
- $\frac{(3a-4)}{(2-a)}$ A1
-

37. (a) $5a(6x^2 + xy - 12y^2)$ MA1
 $5a(3x-4y)(2x+3y)$ MA1 MA1
- (b) $x = \frac{4y}{3}$ $x = \frac{-3y}{2}$ A1 A1
-

38.
$$\frac{3x(x-2y)}{(4x-3y)(x-2y)}$$
 MA1
 Answer = $3x / (4x - 3y)$ MA1

39. $(3x - 2y)(5x + 4y)$ MA2

40. $2(4x^2 - 25y^2)$ MA1
 $2(2x - 5y)(2x + 5y)$ MA2

41. (a) $(2a - b)(a + 4b)$ M1 A1

(b)
$$\frac{(x+1)(x-4) + (3x-4)(2x-1)}{(2x-1)(x-4)} \times \frac{2x-1}{x}$$
 MA1

$$\frac{x^2 - 3x - 4 + 6x^2 - 11x + 4}{(2x-1)(x-4)} \times \frac{(2x-1)}{x}$$
 MA1

$$\frac{7x^2 - 14x}{(x-4)} \times \frac{1}{x}$$
 MA1

$$\frac{7(x-2)}{x-4} \text{ or } \frac{7x-14}{x-4}$$
 A1

42. $4(4x - 1) + (2x - 1)(4x - 1) = 3(2x - 1)$ MA2

$$16x - 4 + 8x^2 - 2x - 4x + 1 = 6x - 3$$

$$8x^2 + 4x = 0$$
 MA1
$$4x(2x + 1) = 0$$
 MA1

So $x = 0$ or $x = -\frac{1}{2}$ A1 A1

43. $\frac{960}{p} = \frac{3}{4} \times \frac{480}{p - 20}$ M1

$$8p - 160 = 3p$$
 MA1

$p = 32$ A1

44. $\frac{1000}{n} - \frac{900}{(n + 5)} = 10$ MA2

$$n^2 - 5n - 500 = 0$$
 MA1

$n = 25$ A1

45.	$\frac{x(x+1)+4(2x-3)}{(2x-3)(x+1)} = 1$	M1
	$\frac{x^2+9x-12}{2x^2-x-3} = 1$	MA1
	$2x^2-x-3 = x^2+9x-12$	MA1
	$x^2-10x+9 = 0$	MA1
	$(x-1)(x-9) = 0$	MA1
	$x = 1, x = 9$	A1

46.	$\frac{2}{x-3} + \frac{3}{2x-5} = 3$	MA1
	$2(2x-5) + 3(x-3) = 3(x-3)(2x-5)$	MA1
	$4x-10+3x-9 = 3[2x^2-6x-5x+15]$	MA1
	$7x-19 = 6x^2-33x+45$	
	$6x^2-40x+64 = 0$	MA1
	$3x^2-20x+32 = 0$	
	$(3x-8)(x-4) = 0$	MA1
	$x = 4, x = 8/3 \text{ (invalid)}$	A1
	$\text{length P} = 2, \text{ length Q} = 1$	A1

47.

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

MA2

$$6x + 9 - 15x - 25 = 2(6x^2 + 19x + 15)$$

$$6x + 9 - 15x - 25 = 12x^2 + 38x + 30$$

MA1

$$12x^2 + 47x + 46 = 0$$

MA1

$$(x + 2)(12x + 23) = 0$$

MA1

$$x = -2 \text{ or } x = -\frac{23}{12}$$

A1 A1

48.

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

MA1

$$\frac{x^2 - x - 6 - 2x^2 - 9x - 4}{x^2 + 6x + 8} = 3$$

MA2

$$-x^2 - 10x - 10 = 3x^2 + 18x + 24$$

MA1

$$4x^2 + 28x + 34 = 0$$

MA1

$$x = \frac{-28 \pm \sqrt{28^2 - 4 \times 4 \times 34}}{8}$$

M1

$$x = -1.56, -5.44$$

A2

49.

$$23 \left(\frac{(2x-3) + (x+4)}{(x+4)(2x-3)} \right) \times \frac{2x^2 - 32}{(3x^2 - 11x - 4)}$$

MA2

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

MA3

$$\frac{2}{(2x-3)}$$

MA1

50.

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

MA1

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

MA1

$$6 - 2a - 15 - 5a = 9 - a^2$$

MA1

$$a^2 - 7a - 18 = 0$$

MA1

$$(a-9)(a+2) = 0$$

MA1

$$a = 9 \text{ or } -2$$

A1