St. Patrick's High School, Keady

Mathematics Department

GCSE Mathematics Practice Booklet

M3

Topic 2 – Algebra 1

The Language of Algebra

Expressions

Equations

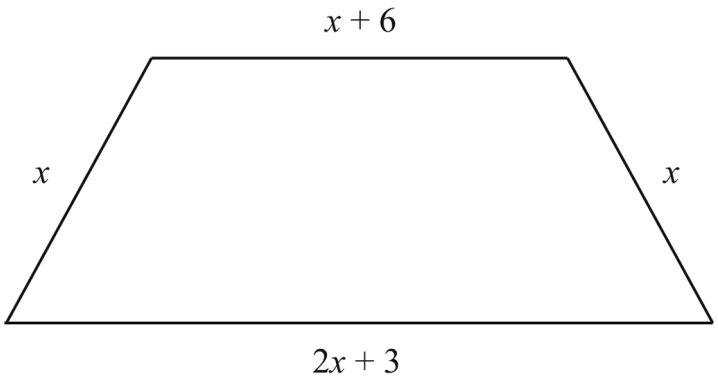
Algebraic Fractions

Questions taken from CCEA Past Papers

Mark Scheme included at the end of this booklet

Q1 **(a)** Write an expression, in terms of x, for the perimeter of the trapezium shown.

Give your answer in its simplest form.



Answer _____ [2]

(b) The perimeter of this trapezium is 34 cm.

(i) Using the perimeter, write down an equation in terms of x.

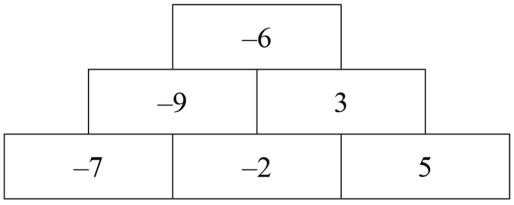
Equation _____ [1]

(ii) Solve the equation to find x.

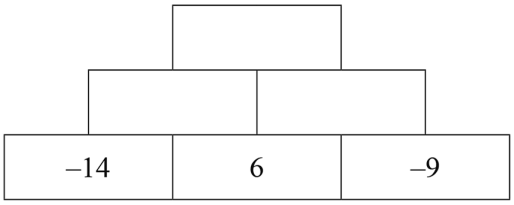
Answer x = _____ [1]

Q2 **(a)** Here is an example of a mathematical pyramid.

To find the number in each box you **add** the two numbers in the boxes beneath it.

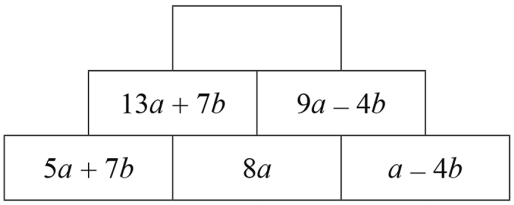


(i) Complete the following pyramid in the same way.



[2]

(ii) Here is an algebraic pyramid. Complete the top box of this pyramid.

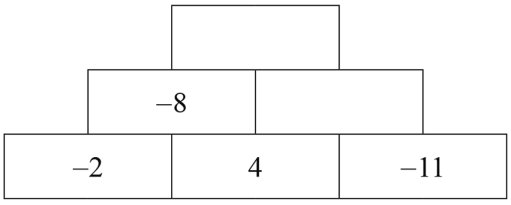


[2]

(b) Here is a different type of pyramid.

To find the number in each box you **multiply** the two numbers in the boxes beneath it.

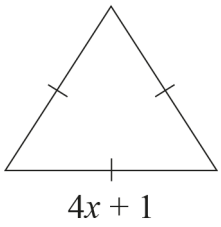
Complete the pyramid.



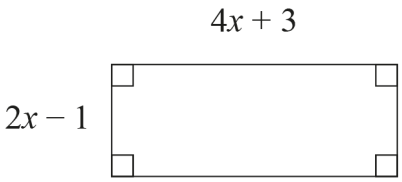
[2]

Q3 Which of these shapes has the greatest perimeter?

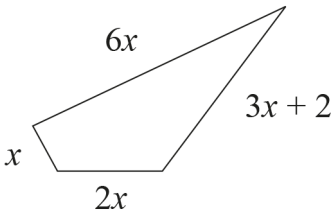
Show all your working.



Shape A



Shape B



Shape C

Answer Shape _____ [4]

Q4 Simplify the expression

$$6e - 5w + 2e - 4w$$

Answer _____ [2]

Q5 Factorise

(a) $8x + 12$

Answer _____ [1]

(b) $x^2 + 7x$

Answer _____ [1]

Q6 Factorise fully each of the following:

(a) $12a + 6$

Answer _____ [1]

(b) $y^2 - 6y$

Answer _____ [1]

(c) $b + b^2$

Answer _____ [1]

Q7 Factorise $3x + 6$

Answer _____ [1]

Q8 Expand and simplify

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

Answer _____ [2]

Q9 Simplify $5a + 2b - 3a - 8b$

Answer _____ [2]

Multiply out $4(3x - 5)$

Answer _____ [2]

Solve $8x - 10 = 6x + 2$

Answer x = _____ [3]

Q10 Factorise

(a) $8p + 12t$

Answer _____ [1]

(b) $r - r^2$

Answer _____ [1]

Q11 Expand and simplify $2y(3y - 7) - 8y$

Answer _____ [3]

Q12 **(a)** Use the formula P = 3Q + 7R to find P when Q = 8 and R = 3

Answer P = _____ [2]

(b) Use the formula V = 3W + 9X to find X when V = 57 and W = 7

Answer X = _____ [3]

(c) $d = \frac{e-f}{g}$

Calculate the value of d when $e = -8$, $f = 12$ and $g = 4$

Answer d = _____ [2]

Q13 $W = 5X - 2Y^2Z$

Work out the value of W for X = 5, Y = –3, Z = 4

Answer W = _____ [3]

Q14 Solve $4(x - 5) = 48$

Answer x = _____ [3]

Q15 Solve

(a) $\frac{x}{5} = 10$

Answer $x =$ _____ [1]

(b) $2x + 5 = 12$

Answer $x =$ _____ [2]

Q16 Solve $4 + 3(2x - 5) = x + 9$

Answer $x =$ _____ [3]

Q17

(a) I think of a number, multiply it by 3 and then add 1

The answer is 28

What was the number?

Answer _____ [2]

(b) I think of a number, subtract 1 from it and then divide by 4

The answer is 3

What was the number?

Answer _____ [2]

Q18

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

Answer $x =$ _____ [3]

Q19

Solve the equations

(a) $5w = 80$

Answer $w =$ _____ [1]

(b) $\frac{t}{8} = 4$

Answer $t =$ _____ [1]

(c) $30 = c + 18$

Answer $c =$ _____ [1]

(d) $9n - 2 = 52$

Answer $n =$ _____ [2]

Q20

A cinema ticket for an adult costs £t

A cinema ticket for a child costs £3

James bought four adult tickets and seven child tickets.

The total cost was £49

(a) Write down an **expression** for the cost of the four adult tickets.

Answer _____ [1]

(b) **(i)** Form an equation that can be solved to find the cost of an adult ticket.

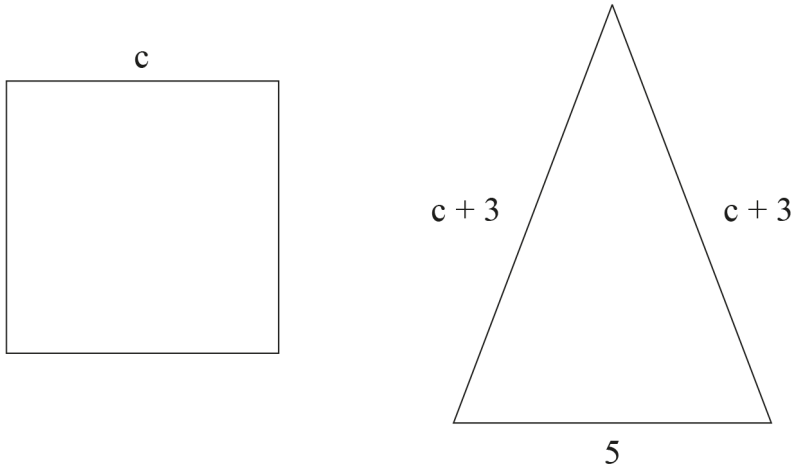
Answer _____ [1]

(ii) Solve your equation to find the cost of an adult ticket.

Answer t = _____ [2]

Q21

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]

Q22

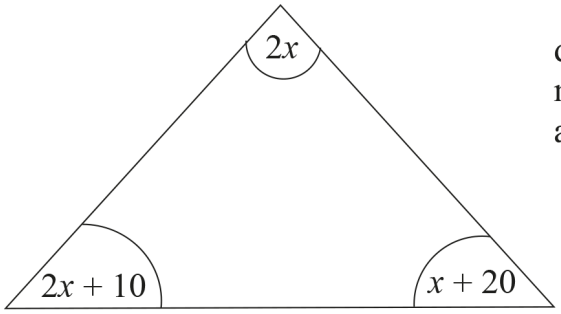


diagram
not drawn
accurately

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

Equation _____ [1]

Answer smallest angle = _____° [3]

Q23

(a) Simplify

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

Answer _____ [2]

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

Answer _____ [2]

Q24

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

Answer _____ [3]

(b) Factorise $t^2 - 49$

Answer _____ [1]

Q25 Factorise fully $14x^2y - 35x$

Answer _____ [2]

Q26 **(a)** Expand $(3x - y)^2$

Answer _____ [2]

(b) Factorise $x^2 - 25$

Answer _____ [1]

Q27 Expand and simplify $(3w - 7)(5w - 8)$

Answer _____ [2]

Q28 **(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]

Q29

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]

Q30

Factorise $y^2 - 6y + 8$

Answer _____ [2]

Q31

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

Answer _____ [2]

Q32

Factorise

(a) $p^2 - 3p$

Answer _____ [1]

(b) $100 - t^2$

Answer _____ [1]

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

Answer _____ [2]

Q33

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

Answer _____ [3]

(b) Simplify $\dfrac{x^2 - 49}{2x - 14}$

Answer _____ [2]

Q34

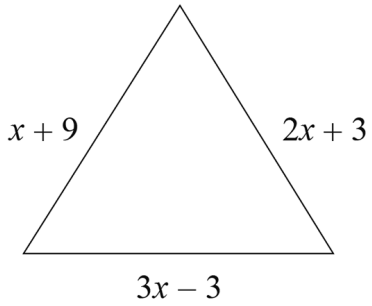
(a) Factorise $x^2 + 2x - 35$

Answer _____ [2]

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

Answer x = _____ [1]

Q35



The diagram shows an equilateral triangle.

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

Equation _____ [1]

Answer perimeter = _____ [3]

Q36 Solve the equation $\frac{2x+3}{4} + \frac{x-1}{3} = 5$

Show all your work.

Answer $x =$ _____ [4]

Q37

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

Answer $x =$ _____ [4]

Q38

Solve

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

Give your answer as a mixed number.

Answer a = _____ [4]

Q39

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

A solution by trial and improvement will not be accepted.

Answer _____ [4]

Q40

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]

Q41

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

Answer y = _____ [4]

Q42

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

Answer _____ [3]

Q43 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]

Q44

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]

Q45 Simplify $\frac{x^2 - 2x}{3} \times \frac{6}{x^2 + 2x - 8}$

Answer _____ [3]

Q46 Simplify $5 - \frac{x + 10}{2}$

Answer _____ [2]

Q47

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

Answer _____ [3]

1. **(a)** $2x + 3 + x + 6 + x + x$ MA1
$5x + 9$ A1

(b) **(i)** $5x + 9 = 34$ MA1

(ii) $5x = 25$
$x = 5$ MA1

---

2. **(a)** **(i)** $-8, -3$ A1
-11 A1

(ii) $22a + 3b$ A1 A1

(b) -44 A1
352 A1

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3. $12x + 3$ MA1

$12x + 4$ MA1

$12x + 2$ MA1

Shape B A1

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4. $8e - 9w$ A1 A1

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5. **(a)** $4(2x + 3)$ MA1

(b) $x(x + 7)$ MA1

---

6. **(a)** $6(2a + 1)$ A1

(b) $y(y - 6)$ A1

(c) $b(1 + b)$ A1

---

7. $3(x + 2)$ A1

---

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

$= 6x - 2$ MA1

---

9. **(a)** $2a - 6b$ A1 A1

(b) $12x - 20$ A1 A1

(c) $8x - 6x = 2 + 10$ MA1

$2x = 12$ MA1

$x = 6$ MA1

---

10. **(a)** $4(2p + 3t)$ A1

(b) $r(1 - r)$ A1

11.

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

12.

(a)	$24 + 21$	MA1
	45	A1
(b)	$57 = 21 + 9X$	MA1
	$9X = 36$	MA1
	$X = 4$	MA1
(c)	$\frac{-20}{4}$	MA1
	-5	A1

13.

$25 - 2 \times 9 \times 4$	MA1
$25 - 72$	A1
-47	A1

---

14. $4x - 20 = 48$ MA1

$4x = 68$ MA1

$x = 17$ A1

or

$x - 5 = 12$ MA2

$x = 17$ A1

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15. **(a)** 50 A1

(b) $2x = 7$ MA1

$x = \frac{7}{2}$ or 3.5 A1

---

16. $4 + 6x - 15 = x + 9$ MA1

$6x - x = 9 - 4 + 15$

$5x = 20$ MA1

$x = 4$ MA1

17.

(a) $28 - 1 = 27$ $\quad \frac{27}{3} = 9$ A1 A1

(b) $3 \times 4 = 12$ $\quad 12 + 1 = 13$ A1 A1

18.

$15x - 10 = 7x + 4$ MA1

$15x - 7x = 4 + 10$

$8x = 14$ MA1

$x = \frac{14}{8}$ or $1\frac{3}{4}$ MA1

19.

(a) 16 A1

(b) 32 A1

(c) 12 A1

(d) $9n = 54$ MA1

6 A1

20.

(a) $4t$ A1

(b) **(i)** $4t + 21 = 49$ (or similar, accept $4t = 28$ but not $t = 7$) A1

(ii) $4t = 28$ MA1
7 A1

21.

4c = 2c + 11 MA1
2c = 11 MA1
c = 5.5 A1
22 A1

22.

$2x + 10 + 2x + x + 20 = 180$ M1

$5x = 150$ MA1

$x = 30$ MA1

Smallest angle = 50 A1

---

23. **(a)** $5t - 10 - 12 + 6t$ MA1

$11t - 22$ A1

(b) $e^2 - 7e + 4e - 28$ MA1

$e^2 - 3e - 28$ A1

---

24. **(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

---

25. $7x(2xy - 5)$ A2

(A1 for correct partial factorisation)

26.

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

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

27.

$15w^2 - 24w - 35w + 56$ M1
$15w^2 - 59w + 56$ A1

28.

(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

---

29. **(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

---

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

---

31. $p^2 - 6p + 2p - 12$ MA1

$p^2 - 4p - 12$ A1

32.

(a) $p(p-3)$ A1

(b) $(10-t)(10+t)$ A1

(c) $(x+5)(x-3)$ A2

33.

(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

34.

(a) $(x+7)(x-5)$ MA2

(b) $x=-7$ or 5 MA1

35.

$x+9=2x+3$ **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

36.

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

37.

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

alternative solution

$\frac{x + 3}{2} - \frac{5x}{6} = 0 \quad (\times 6)$

$3(x + 3) - 5x = 0$	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

38.

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

39.

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

40.

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

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41. Multiplying by 4

$y + 3 - 8 = 2(3 - 2y)$ MA1

$y + 3 - 8 = 6 - 4y$ MA1

$5y = 11$ MA1

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

Alternative solution

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

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

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

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

---

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

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

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

---

43. $\frac{2(2x-1)+3(x+2)+x}{6}=8$ 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

---

44. $6(3x+2)-5(3x-4)=2$ 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

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

$= \frac{2x}{x+4}$ A1

---

46. $\frac{10-(x+10)}{2}$ MA1

$= -\frac{x}{2}$ A1

Alternative solution

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

$= -\frac{x}{2}$ A1

---

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