Exampro Lite GCSE Maths

Simultaneous Equations
Markscheme at back

Name:

Class:
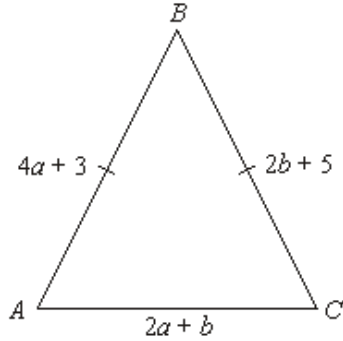

Author:

Date:

Time:

Marks: 51

Comments:

Q1.   *ABC* is an isosceles triangle.
The lengths, in cm, of the sides are

$AB = 4a + 3$, $BC = 2b + 5$ and $AC = 2a + b$

Not to scale

(a) $AB = BC$

Show that $2a - b = 1$

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(2)

(b)   The perimeter of the triangle is 32 cm. Find the values of *a* and *b*.

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Answer *a* = ... cm, *b* =....................... cm

(4)
(Total 6 marks)

Q2. Solve these simultaneous equations

$$x + 3.6y = 2$$
$$x - 2.4y = 5$$

You **must** show all your working.
Do **not** use trial and improvement.

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Answer x = ...

y = ...

(Total 3 marks)

Q3. Solve the simultaneous equations $4x + 3y = 14$ $2x + y = 5$

You **must** show your working.
Do **not** use trial and improvement.

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Answer x = ... , y = ...

(Total 3 marks)

Q4. Two gas supply companies have different ways of charging for the gas they supply.

Alpha gasCO	
Fixed Charge	£9.60
Price per kilowatt hour of gas	First 5 kilowatt hours free then £1.30 for every kilowatt hour over 5.

Beta gasCO	
Fixed Charge	No fixed charge
Price per kilowatt hour of gas	£1.50 for every kilowatt hour.

Find the number of kilowatt hours after which Alpha gasCo becomes cheaper than Beta gasCo.

You might want to use some graph paper.

You **must** show your method clearly.

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Answer .... kilowatt hours

(Total 4 marks)

Q5. (a) Factorise $7x + 14$

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Answer ....

(1)

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

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Answer ....

(2)

(c)   Solve the simultaneous equations:

$$2x + 3y = 9$$
$$3x + 2y = 1$$

You **must** show all your working.
Do **not** use trial and improvement.

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Answer $x =$ ...., $y =$ ....

(4)

(d)   Factorise $x^2 + 6x - 16$

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Answer ....

(2)
(Total 9 marks)

Q6. The diagrams show a trapezium and a parallelogram.
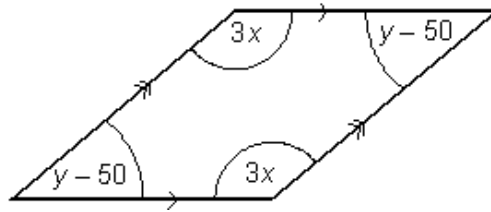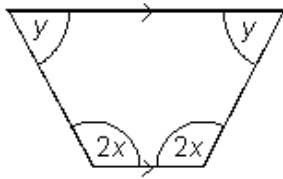
Not drawn accurately

(a) Use the trapezium to explain why $2x + y = 180$

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(1)

(b) The parallelogram can be used to form another equation connecting x and y.

Tick a box to show the correct equation.

☐ $3x + y = 130$ ☐ $3x + y = 230$

☐ $3x = y - 50$ ☐ $3x + y = 410$

(1)

(c) Hence, or otherwise, work out the values of x and y.

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Answer $x =$ .... , $y =$ …................

(3)
(Total 5 marks)

Q7. Solve the simultaneous equations

$$x + 3y = 11$$
$$2x - y = 1$$

You **must** show your working.
Do **not** use trial and improvement.

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Answer $x = $ .... , $y = $ ....

(Total 3 marks)

Q8. $x^a \times x^b = x^7$

$(x^a)^b = x^{10}$

Work out the values of a and b.

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Answer $a = $ ...., $b = $ ....

(Total 3 marks)

Q9. Four identical circular discs fit into a rectangle 10 cm long.

Not drawn accurately

←—10 cm—→
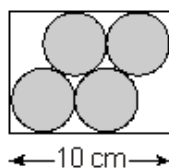
Ten of the same discs fit into a rectangle 22 cm long.
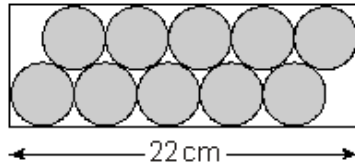
Not drawn accurately

24 discs are placed together in the same way.

How long is the rectangle?

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Answer ....cm

(Total 3 marks)

Q10.   The rule for continuing a Fibonacci sequence is to add the last two terms to make the next term.

For example, the sequence that starts 1, 1, … continues as 1, 1, 2, 3, 5, 8, …

Two other Fibonacci sequences start a, $2a$, …… and b, $4b$, …

The fifth terms of these two sequences are equal.

Given that $a + b = 11$, work out the values of a and b.

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Answer $a = $ .... $b = $ ....

(Total 4 marks)

Q11. Solve the simultaneous equations

$$2x + 5y = 16$$

$$4x + 3y = 11$$

You **must** show your working.

Do **not** use trial and improvement.

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Answer ....

(Total 3 marks)

Q12. Two families go to a pantomime.

The Khan family of two adults and three children pay £69.

The Lewis family of three adults and five children pay £109.

Work out the cost of an adult ticket and the cost of a child ticket.

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Answer   Adult ticket £ ....   Child ticket £ ....

(Total 5 marks)

M1.   (a) $4a + 3 = 2b + 5$

                                                                                        M1

    (b) $4a - 2b = 2$ (-2)

                        Must indicate division by 2

                                                                                        A1

        $4a+3+2b+5+2a+b=32$

        $6a + 3b = 24$

        $2a + b = 8$

                        BI for any version

                                                                                        M1

        (1) × 3: $6a - 3b = 3$

                                                                                        M1

        $12a = 27$

                        For attempt to eliminate
                        AB or 4a + 3 =12 and BC or 2b + 5 = 12

                                                                                        M1

        $a = 2.25$

                                                                                        A1
                                                                                        [6]

M2.   trial and improvement is 0

    1st-2nd

                        6y = − 3 allow 1 error eg, 12y = − 3 6y = 3
                        2 − 3.6y = 5 + 2.4y allow 1 error or
                        2.4equation(l) + 3.6equation(2)

                                                                                        M1

    $y = - 0.5$ or $x = 3.8$

                                                                                        A1

    $y = - 0.5$ and $x = 3.8$

                        Must have both.
                        Allow reversed if both seen correct in working
                        ft if MI awarded

                                                                                        A1 ft
                                                                                        [3]

M3. $4x + 3y = 14$ $4x + 3y = 14$
   $4x + 2y = 10$ $6x + 3y = 15$

   allow error in <u>one</u> term

M1

   $y = 4$ $2x = 1$

   correct elimination from their equations

M1

   $x = \frac{1}{2}$ **and** $y = 4$

   oe
   SC correct answers with no working or using T & I

A1

[3]

M4. $9.60 + (x - 5) \times 1.30$

   Alt: M1 for graph of Alpha parcels

M1

   $= 1.50x$

   M1 for graph of Beta

M1

   $3.10 = 0.20x$

   A1 accuracy

A1

   $x = 15.5$

   A1 answer. Accept 16 but not 15.
   T&I gets M1 iff taken as far as 15.
   A1 for both schemes at 15
   A1 for both schemes at 16
   A1 conclusion

A1

[4]

M5.   (a) $7(x + 2)$

   allow one error

B1

   (b) $4m + 12 + 6m - 15$

M1

   $10m - 3$

   allow 10m + ⁻3

A1

(c)　6x + 9y = 27　　4x + 6y = 18
　　　<u>and</u>　　or　　<u>and</u>
　　6x + 4y = 2　　　9x + 6y = 3

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　M1

　　5y = 25　　　or　　5x = −15

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　M1 dep

　　y = 5　　　　<u>or</u>　　x = − 3

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　A1

　　x = − 3　　　<u>and</u>　　y = 5

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　A1

　　　　　SC1 correct answer with no working or using T&I

(d)　(x + 8)(x − 2)
　　　　　　　B1 (x ± 8)(x ± 2)

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　B2

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[9]

M6.　　(a)　Valid explanation

　　　　　　　eg　allied angles (add up to 180)
　　　　　　　　　inside parallel lines (add up to 180)
　　　　　　　　　y + y + 2x + 2x = 360 so y + 2x = 180
　　　　　　　　　2y + 4x = 360
　　　　　　　　　In a C add up to 180
　　　　　　　Condone interior angles (add up to 180)

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　B1

(b)　3x + y = 230
　　　　　　oe

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　B1

(c)　Attempt to eliminate a variable
　　（with 2x + y = 180)
　　　　　　　eg　6x + 2y = 460 and 6x + 3y = 540 and subtraction
　　　　　　　Note: Full marks can be awarded for this part on
　　　　　　　　　follow through

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　M1

　　x = 50

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　A1 ft

　　y = 80

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　A1 ft

　　　　　　　3x + y = 130 → x = −50, y = 280
　　　　　　　3x = y −50 → x = 26, y = 128
　　　　　　　3x + y = 410 → x = 230, y = −280

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[4]

M7. $2x + 6y = 22$

$6x – 3y = 3$

M1

$7y = 21$

$7x = 14$

A1

$y = 3$ and $x = 2$

A1

[3]

M8. $a + b = 7$

M1

$ab = 10$

M1

$a = 2, b = 5$

$a = 5, b = 2$

B1

[3]

M9.   Evidence of searching for a pattern
or $r = 2$ or $d = 4$
or 6 extra discs gives extra 12 cm

*eg,   4 → 10, 10 → 22 or
5 → 10, 11 → 22 or markings on
diagram or diagram of 24 discs (2 rows)
6 extra discs gives extra 12 cm*

M1

$2n + 2$ or $2(n + \dfrac{1}{2})$

or 14 extra discs gives 28 cm
or 20 extra discs gives 40 cm

*12d + r or 25r
22 + 28
10 + 40*

M1

50

A1

[3]

M10. 8*a*

$$8a = 14b \text{ or } 4a = 7b \text{ M1}$$

B1

14*b*

$$4a + 4b = 44 \text{ or } 7a + 7b = 77 \text{ M1}$$

B1

a = 7 answers only with no working is zero marks

$$11b = 44 \text{ or } 11a = 77 \text{ A1}$$

B1

b = 4 allow answers reversed

$$a = 7 \text{ and } b = 4 \text{ A1}$$

B1

[4]

M11. $4x + 10y = 32 \qquad 6x + 15y = 48$

$(4x + 3y = 11) \qquad 20x + 15y = 55$
oe
Allow one error

M1

$7y = 21$ or $14x = 7$
oe

A1 ft

$y = 3$ and $x = \dfrac{1}{2}$
SC1 for no working or T&I

A1

[3]

M12. $2a + 3c = 69$
$3a + 5c = 109$

B1 one equation correct
Any letters may be used but need to be consistent for B2

B2

× 1st by 3 or 5
× 2nd by 2 or 3
oe (to obtain consistent coefficients)

M1

Two equations (max one error) and subtraction

$$eg, \quad 6a + 9c = 207$$

$$6a + 10c = 218 \text{ and subtraction}$$

M1 dep

Adult (a =) 18 Child (c =) 11

A1

[5]