GCSE Foundation/Higher 12

Algebra

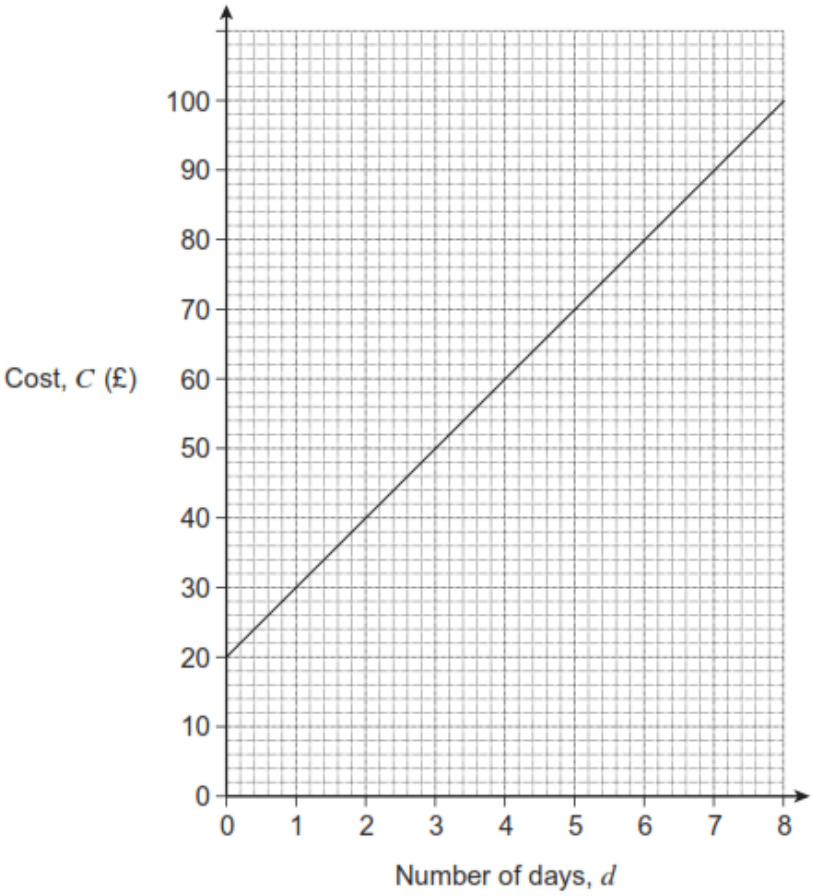
Questions

91 minutes

83 marks

Formulae

Q1. The graph shows the cost, C (£), of hiring a car for d days from Roy's Rentals.



(a) Circle the correct formula for hiring a car from Roy's Rentals.

$C = 20d + 100$ $C = 10d + 20$ $C = 20d + 10$ $C = 5d + 20$

(1)

(b) The cost of hiring a car from First Cars is given by the formula $C = 8d + 30$

Plot the graph of $C = 8d + 30$ on the grid above.

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(2)

(c) Toby wants to hire a car for 7 days.

Which of these firms should he use?
Give a reason for your answer.

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(2)
(Total 5 marks)

Q2. (a) Solve $\frac{12 - x}{3} = 5$

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Answer x = ...

(3)

(b) Rearrange this formula to make t the subject.

$s = 3t + 4$

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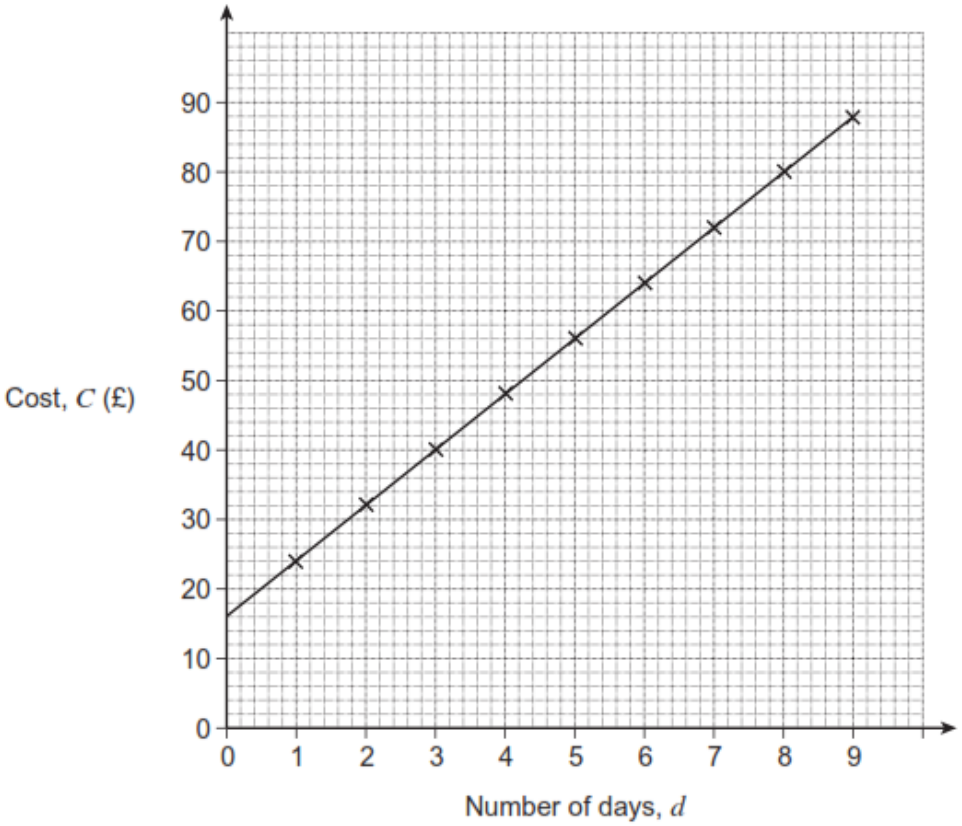
Answer t = ...

(2)
(Total 5 marks)

Q3. The graph shows the cost, C (£), of hiring a circular saw from Branch Tool Hire for a number of days, d.



(a) Circle the correct formula for the cost, C.

$C = 24d$ $C = 8d + 24$ $C = 16d + 8$ $C = 8d + 16$

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(1)

(b) The cost of hiring a circular saw from Woods Tool Hire is given by the formula

$$C = 9d + 11$$

Sam thinks that Woods Tool Hire is always cheaper.

Is this true?
Tick a box.

Yes ☐ No ☐

Give reasons for your answer.

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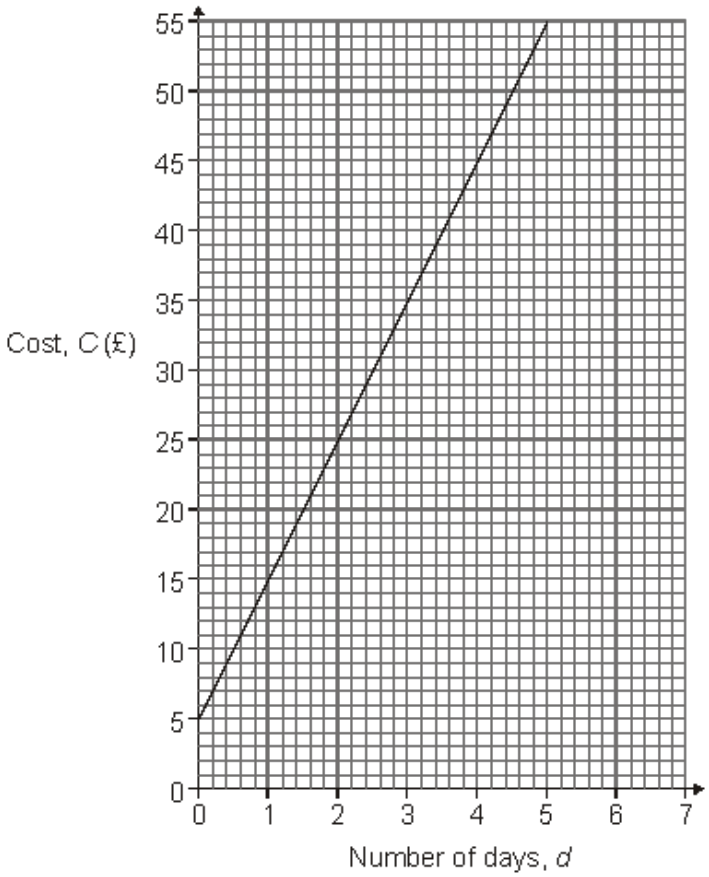
(3)
(Total 4 marks)

Q4. An activity centre hires out road bikes and mountain bikes.

The graph shows the cost, C (£) of hiring a road bike for a number of days, d.



(a) Circle the correct formula connecting the cost, C and the number of days, d for hiring a road bike.

$C = 2d + 5$ $C = 5d + 10$ $C = 10d + 5$

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(1)

(b) The cost of hiring a mountain bike is given by the formula $C = 5d + 15$

Rowan would like to hire a mountain bike.

He thinks that a mountain bike will always cost more to hire than a road bike.

Is this true? Yes ☐ No ☐

Explain your answer.

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(3)

(Total 4 marks)

Q5. (a) Work out the value of $8(16 - 1)$

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Answer .....

(1)

(b) Factorise $2x^2 - x$

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Answer .....

(1)

(c) Work out the value of $2x^2 - x$ when $x = 8$

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Answer .....

(1)

(Total 3 marks)

Q6. (a) Rearrange the formula to make t the subject.

$$S = 3t + 40$$

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Answer .....

(2)

(b) Solve $3t + 40 < 70$

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Answer .....

(2)

(Total 4 marks)

Q7. After exercise you can work out your fitness index, F.

You need to know

your exercise time in seconds (T)

the number of your pulse beats in three 30 second intervals after you have stopped exercising (a, b and c).

Terry is working out his fitness index.

(a) (i) Terry exercises for 3 minutes 30 seconds.

Work out T

.....

Answer ..... seconds

(1)

(ii) After exercise he obtains $a = 70$, $b = 55$ and $c = 45$

Work out $a + b + c$.

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Answer ..... pulse beats

(1)

(iii) Work out F, Terry's fitness index, using the formula

$$F = \frac{50T}{a+b+c}$$

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Answer ..... seconds

(2)

(b) Your fitness grade can be worked out from your fitness index, *F*, using this table.

Fitness index, *F*	less than 50	50 to 59	60 to 69	70 to 79	80 to 89	≥ 90
Fitness grade	Very poor	Poor	Fair	Good	Excellent	Superb

What is Terry's fitness grade?

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Answer .....

(1)

(Total 5 marks)

Q8. Make *x* the subject of $y = 4x - 3$

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Answer *x* = ...

(Total 2 marks)

Q9. (a) (i) The terms in a sequence are of the form $2p^2$, where p is a prime number.

Show that 8, 18 and 50 are the first three terms in this sequence.

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(2)

(ii) Work out the next term in the sequence.

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Answer .....

(1)

(b) The smallest number with exactly three **different** prime factors is 30.

$30 = 2 \times 3 \times 5$

What is the next smallest number that has exactly three different prime factors?

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Answer .....

(2)

(Total 5 marks)

Q10. Two car hire firms use different ways of charging for the hire of a car.

(a) Cheap Days uses this formula.

$H = 50d + 120$

H is the hire charge in pounds.
d is the number of days the car is hired.

Work out H when $d = 2$

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Answer £.....

(2)

(b) Cheap Miles uses this formula.

$$H = \frac{m + 750}{5}$$

H is the hire charge in pounds.
m is the number of miles the car travels.

Work out *m* when *H* = 200

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Answer ..... miles

(2)
(Total 4 marks)

Q11. This table shows some corresponding values of *x* and *y*.

x	–2	–1	0
y	1	2	3

This table shows some relationships between *x* and *y*.

Relationship	**True/False**
$y = x + 3$	
$y = (x + 2)^3 + 1$	

Put True in the last column if the relationship is true for all three pairs of values.
Put False in the last column if the relationship is **not** true for all three pairs of values.

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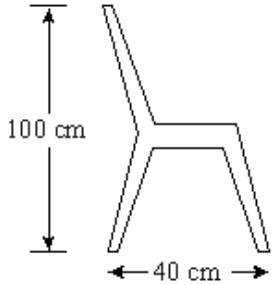
(Total 2 marks)

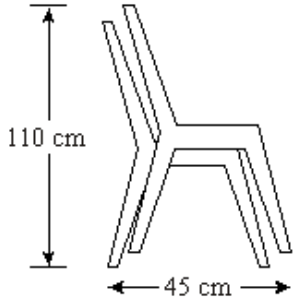
Q12. A stacking chair is 100 cm high and 40 cm wide.

Not drawn accurately



When a chair is added to a stack it increases the height by 10 cm and the width by 5 cm.

Not drawn accurately



(a) Find an expression for the height of a stack of n chairs.

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Answer .....

(2)

(b) A rule for the maximum number of chairs that can be stacked before they fall over is

$$4n + 35 < 70$$

What is the maximum number of chairs that can be stacked?

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Answer .....

(3)

(Total 5 marks)

Q13. (a) Simplify $2x + 8 + 4x - 3$

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Answer .....

(2)

(b) Solve the equation.

$$\frac{x}{3} = 5$$

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Answer x = ...

(1)

(c) Tom is investigating the two expressions $ab + c$ and $a(b + c)$

(i) He finds that both expressions have the same value when $a = 1$, $b = 3$ and $c = 4$. Show that this is true.

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(3)

(ii) Tom says that this means that $a(b + c) = ab + c$. Explain why Tom is wrong.

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(2)

(Total 8 marks)

Q14. (a) Simplify

(i) $y^7 \times y^2$

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Answer .....

(1)

(ii) $y^7 \div y^2$

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Answer .....

(1)

(iii) $(y^7)^2$

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Answer .....

(1)

(b) (i) If $y = -1$ which answer in part (a) is positive?

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Answer .....

(1)

(ii) If $y = 0.5$ which answer in part (a) has the greatest value?

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Answer .....

(1)
(Total 5 marks)

Q15. P is a prime number.
Q is an odd number.
State whether each of the following is always odd or always even or could be either odd or even.
Tick the appropriate box.

(a) $P(Q + 1)$

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Always odd	Always even	Could be either odd or even
☐	☐	☐

(1)

(b) $Q - P$

Always odd	Always even	Could be either odd or even
☐	☐	☐

(1)
(Total 2 marks)

Q16. (a) Find the value of $3x + 5y$ when $x = -2$ and $y = 4$

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Answer .....

(2)

(b) Find the value of $3a^2 + 5$ when $a = 4$

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Answer .....

(2)

(c) k is an even number.

Jo says that $\frac{1}{2}k + 1$ is always even.

Give an example to show that Jo is wrong.

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(1)

(d) The letters a and b represent prime numbers. Give an example to show that $a + b$ is **not** always an even number.

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(1)

(Total 6 marks)

Q17. P is an odd number.
Q is an even number.

(a) Explain why $P + Q - 1$ is **always** an even number.

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(2)

(b) Alex says that $P + Q - 1$ **cannot** be a prime number.
Explain why Alex is wrong.

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(1)
(Total 3 marks)

Q18. (a) p is an odd number.

Is $2p + 1$ an odd number, an even number or could it be either?
Tick the correct box.

☐ odd ☐ even ☐ either

(1)

(b) p is an odd number.
Explain why $p^2 + 1$ is always an even number.

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(2)
(Total 3 marks)

Q19. (a) Find the value of $3x + 4y$ when $x = 6$ and $y = -3$

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Answer .....

(2)

(b) Sam buys x packets of sweets.
Each packet of sweets costs 22 pence.
Sam pays with a £5 note.
Write down an expression for the change, in pence, Sam should receive.

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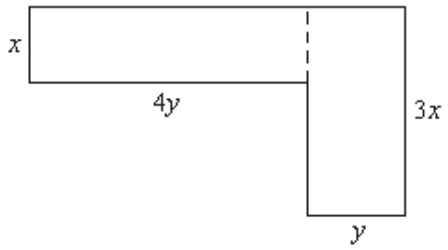
Answer ..... pence

(2)
(Total 4 marks)

Q20. This shape is made up of rectangles.



Not to scale

(a) Write down an expression, in terms of x and y, for the **perimeter** of the shape.

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Answer .....

(2)

(b) If x = 2 cm and y = 5 cm, find the **area** of the shape.

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Answer ..... cm^2

(2)
(Total 4 marks)