



KS3.M-A12 Writing and Using Formulae

AQA KS3.M-A12 · Calculators not allowed · about 60 minutes

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

1 Write a formula for each description. Use a single letter for the variable.

(a) The perimeter P of a square with side length s . (1)

(b) The total cost C in pounds for buying n notebooks at 1.75 pounds each. (1)

(c) The area A of a rectangle with width w and length l . (1)

(d) Total marks T when a test has q questions worth 2 marks each and m questions worth 3 marks each. (1)

2 Substitute and evaluate. Use the formula $S = 2h + 5$.

(a) Find S when $h = 4$. (1)

(b) Find S when $h = 0$. (1)

(c) Find S when $h = -2$. (1)

3 A car travels at a constant speed. Distance d in kilometres is given by $d = 50t$, where t is time in hours.

(a) How far does the car travel in 1.5 hours? Give your answer in km. (2)

.....
(b) How long does it take to travel 125 km? Give your answer in hours. (1)

.....

4 Use formulae with units. The formula for average speed v in m/s is $v = s / t$, where s is distance in metres and t is time in seconds.

(a) A runner covers 400 m in 50 s. Find the average speed in m/s. Give your answer as a decimal to two decimal places. (2)

.....
(b) A skateboarder travels at 2 m/s for 45 s. Find the distance covered in metres. (2)

.....

5 Rearrange the simple formula and solve. The formula is $A = 3x + 7$.

(a) Given $A = 16$, find x . (2)

.....
(b) Given $A = -2$, find x . (1)

.....

6 The area of a triangle is given by $A = \frac{1}{2} b h$. Rearrange to make h the subject.

(a) Rearrange $A = \frac{1}{2} b h$ to make h the subject. (3)

(b) Use your rearranged formula to find h when $A = 24$ and $b = 6$. (1)

7 Write a formula from a worded rule. Each question uses the same letter for the unknown.

(a) Multiply a number n by 6, then subtract 4. Call the result R . (1)

(b) Add 9 to a number p , then divide the result by 3. Call the result S . (1)

(c) Double a number x , then square the result. Call the result T . (1)

8 Substitute negative and fractional values into formulae. Use $C = 5t - 3$.

(a) Find C when $t = -1$. (1)

(b) Find C when $t = \frac{1}{2}$. (2)

9 Rearrange to make x the subject. Start from $4x + 9 = y$.

(a) Rearrange $4x + 9 = y$ to make x the subject. (3)

(b) Use your formula to find x when $y = 17$. (1)

10 A mobile phone company charges a fixed monthly fee F plus 12 p per minute for calls. The cost in pence is $C = F + 12m$ where m is minutes.

(a) If $F = 350$ pence, find C for $m = 40$ minutes. (2)

(b) If a customer pays 674 pence in total and $F = 350$ pence, how many minutes did they use? Give your answer as an integer. (1)

11 Compound operations and formulae. The formula $M = 3(a - b) + 2b$ is used.

(a) Simplify the expression M in terms of a and b . (2)

(b) Find M when $a = 4$ and $b = 1$. (1)

12 Stretch 1: A small triangle and a similar big triangle have corresponding sides in ratio 1:n. Area of the small triangle is A_s and area of the big triangle is A_b . Let $A_b = k A_s$. Express k in terms of n and use it to find A_b when $A_s = 6$ and $n = 3$.

(a) Write k in terms of n , knowing area scales as the square of linear scale factor. (2)

(b) Find A_b when $A_s = 6$ and $n = 3$. (2)

13 Stretch 2: A formula for the temperature T in degrees C after t hours is $T = 20 - 3t$. Two students disagree about when T reaches 2 degrees C. Use the formula to find t and state if t is positive.

(a) Solve $20 - 3t = 2$ for t . (1)

(b) Is t positive? Give a brief reason. (1)

14 Final fluency: Match each algebraic expression to its word description.

(a) Expression: $7m$. Description choices: (i) m increased by 7, (ii) 7 times m , (iii) m divided by 7. (1)

☐ (i) m increased by 7

☐ (ii) 7 times m

☐ (iii) m divided by 7

(b) Expression: $n - 5$. Description choices: (i) subtract n from 5, (ii) n minus 5, (iii) 5 minus n . (1)

☐ (i) subtract n from 5

☐ (ii) n minus 5

☐ (iii) 5 minus n

Mark scheme · KS3.M-A12 Writing and Using Formulae

Question 1

- (a) **B1** $P = 4s$ cao
- (a) Answer: **$P = 4s$**
- (b) **B1** $C = 1.75n$ cao
- (b) Answer: **$C = 1.75n$**
- (c) **B1** $A = l w$ or $A = lw$ cao
- (c) Answer: **$A = l w$**
- (d) **B1** $T = 2q + 3m$ cao
- (d) Answer: **$T = 2q + 3m$**

Question 2

- (a) **B1** $S = 13$ cao
- (a) Answer: **13**
- (b) **B1** $S = 5$ cao
- (b) Answer: **5**
- (c) **B1** $S = 1$ cao
- (c) Answer: **1**

Question 3

- (a) **M1** substitution $d = 50 \times 1.5$ or equivalent method
- (a) **A1** 75 km cao
- (a) Answer: **75 km**
- (b) **B1** 2.5 hours cao
- (b) Answer: **2.5 hours**

Question 4

- (a) **M1** substitution $v = 400/50$ or equivalent
- (a) **A1** 8.00 m/s cao
- (a) Answer: **8.00 m/s**
- (b) **M1** substitution $s = v \times t$ or equivalent
- (b) **A1** 90 m cao
- (b) Answer: **90 m**

Question 5

- (a) **M1** form $3x + 7 = 16$ and subtract 7 or equivalent method
- (a) **A1** $x = 3$ cao
- (a) Answer: **3**
- (b) **B1** $x = -3$ cao
- (b) Answer: **-3**

Question 6

- (a) **M1** multiply both sides by 2 or show $2A = b h$
- (a) **M1** divide both sides by b or show $h = 2A / b$
- (a) **A1** $h = 2A / b$ cao
- (a) Answer: **$h = 2A / b$**
- (b) **B1** $h = 8$ cm or units not required but value 8 cao
- (b) Answer: **8**

Question 7

- (a) **B1** $R = 6n - 4$ cao
- (a) Answer: **$R = 6n - 4$**
- (b) **B1** $S = (p + 9) / 3$ or $S = (p+9)/3$ cao
- (b) Answer: **$S = (p + 9) / 3$**
- (c) **B1** $T = (2x)^2$ or $T = 4x^2$ cao
- (c) Answer: **$T = (2x)^2$**

Question 8

- (a) **B1** $C = -8$ cao
- (a) Answer: **-8**
- (b) **M1** substitution $5 \times 1/2 - 3$ or equivalent
- (b) **A1** -0.5 or $-1/2$ cao
- (b) Answer: **-0.5**

Question 9

- (a) **M1** subtract 9 from both sides or show $4x = y - 9$
- (a) **M1** divide both sides by 4 or show $x = (y - 9) / 4$
- (a) **A1** $x = (y - 9) / 4$ cao
- (a) Answer: **$x = (y - 9) / 4$**
- (b) **B1** $x = 2.0$ or 2 cao
- (b) Answer: **2**

Question 10

- (a) **M1** substitution $C = 350 + 12 \times 40$ or equivalent
- (a) **A1** 830 pence cao
- (a) Answer: **830**
- (b) **B1** $m = 27$ cao
- (b) Answer: **27**

Question 11

- (a) **M1** expand $3(a - b)$ to $3a - 3b$ or equivalent
- (a) **A1** $M = 3a - b$ cao
- (a) Answer: **$M = 3a - b$**
- (b) **B1** $M = 11$ cao
- (b) Answer: **11**

Question 12

- (a) **M1** state area scale factor = n^2 or show $k = n^2$
- (a) **A1** $k = n^2$ cao
- (a) Answer: **$k = n^2$**
- (b) **M1** substitute $Ab = n^2 \times As$ with $n=3$, $As=6$
- (b) **A1** 54 cao
- (b) Answer: **54**

Question 13

- (a) **M1** correct algebra to $t = 6$
- (a) Answer: **6**
- (b) **B1** Yes, $t = 6$ which is greater than 0 or statement that t is positive because solution is 6
- (b) Answer: **Yes**

Question 14

- (a) **B1** choice (ii) 7 times m
- (a) Answer: **(ii)**
- (b) **B1** choice (ii) n minus 5
- (b) Answer: **(ii)**