

# FORMULAE (FOUNDATION)

DATE OF SOLUTIONS: 15/05/2018

MAXIMUM MARK: 53

# SOLUTIONS

GCSE (+ IGCSE) EXAM QUESTION PRACTICE

1. [Edexcel, 2004]

Formulae [2 Marks]

The word formula gives the time, in minutes, needed to cook a turkey.

$$\text{Time} = 40 \times \text{weight in kg} + 20$$

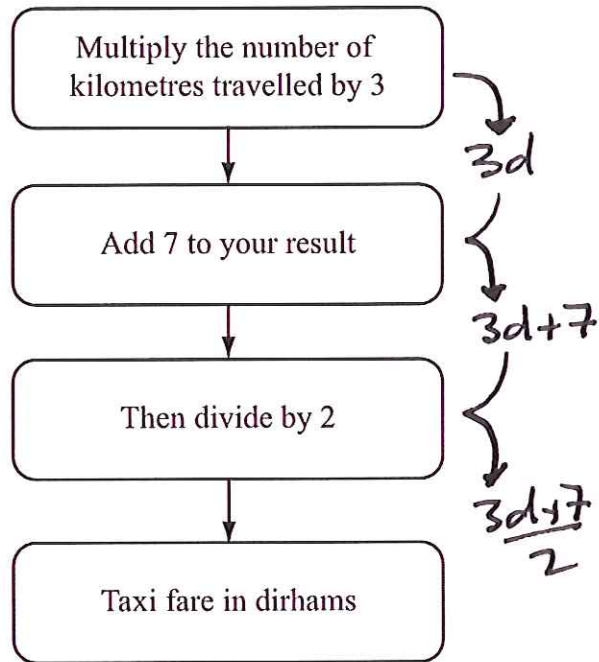
A time of  $T$  minutes is needed to cook a turkey with a weight of  $W$  kg.

Write down a formula for  $T$  in terms of  $W$ .

$$T = 40W + 20$$

*(Handwritten solution with red annotations: a circled 'A1' with an arrow pointing to the 'T' on the left, and another circled 'A1' above the '40W' term.)*

This rule can be used to work out the fare, in dirhams, for a taxi journey in Dubai.



Find a formula for the fare,  $C$  dirhams, for a taxi journey of  $d$  kilometres.

$$C = \frac{3d+7}{2}$$

Handwritten annotations in red ink:

- A circled "BI" with an arrow pointing to the coefficient 3 in the numerator.
- A circled "BI" with an arrow pointing to the constant term 7 in the numerator.
- A circled "BI" with an arrow pointing to the denominator 2.

$a = 6 \quad b = 2.84$

$c = \sqrt{5}$

$c^2 = 5!$

Work out the value of

$\frac{a-b}{c^2}$

$$\frac{a-b}{c^2} = \frac{6-2.84}{5}$$

$$= \frac{3.16}{5}$$

$$= \underline{\underline{0.632}}$$

(B1)

(A1)

Work out the value of  $\frac{a(b+1)}{16}$  when  $a = 6$  and  $b = -9$

$$\begin{aligned} \textcircled{m1} \quad \frac{6 \times (-9+1)}{16} &= \frac{6 \times -8}{16} \\ &= -\frac{48}{16} \quad \textcircled{m1} \end{aligned}$$

..... -3  $\textcircled{A1}$

$$f = \frac{uv}{u+v}$$

Work out the value of  $f$  when  $u = 5.7$  and  $v = -7.6$

$$f = \frac{(5.7) \times (-7.6)}{(5.7) + (-7.6)}$$

$$f = \dots\dots\dots 22.8$$

$$D = 3e^2 + 4e$$

Work out the value of  $D$  when  $e = -5$

$$D = 3(-5)^2 + 4(-5) \quad (\text{m1})$$

$$D = \dots\dots\dots 55 \quad (\text{A1})$$

$$m = -3$$

$$n = -4$$

(a) Work out the value of  $3m^2 + 5n$

$$3(-3)^2 + 5(-4) \quad (M1)$$

$$\underline{\quad 7 \quad} \quad (A1)$$

(2)

There are 4 batteries in a small pack of batteries.

There are 12 batteries in a large pack of batteries.

Lottie buys  $x$  small packs of batteries and  $y$  large packs of batteries.

She buys a total of  $T$  batteries.

(b) Write down a formula for  $T$  in terms of  $x$  and  $y$ .

$$\underline{T = 4x + 12y} \quad (A1)$$

(2)

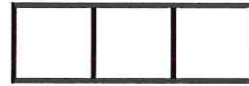
Here is a pattern of shapes made from centimetre squares.



Shape  
number 1



Shape  
number 2



Shape  
number 3

This rule can be used to find the perimeter of a shape in this pattern.

Add 1 to the Shape number and then multiply your answer by 2

$P$  cm is the perimeter of Shape number  $n$ .

(a) Write down a formula for  $P$  in terms of  $n$ .

$$\begin{array}{c} \textcircled{AD} \quad \textcircled{AD} \quad \textcircled{AD} \\ \hline P = 2(n+1) \\ \hline \textcircled{3} \end{array}$$

(b) Make  $n$  the subject of the formula in part (a).

$$P = 2(n+1)$$

$$n+1 = \frac{P}{2} \quad \textcircled{mi} \text{ [DIVIDE BY 2]}$$

$$\underline{\underline{n = \frac{P}{2} - 1}} \quad \textcircled{mi} \text{ [SUBTRACT 1]}$$



$$M = 3x^2 - nx$$

(a) Work out the value of  $M$  when

$$x = -2 \text{ and } n = 5$$

$$\begin{aligned} M &= 3 \times (-2)^2 - 5 \times (-2) \quad (\text{mi}) \\ &= 3 \times 4 + 10 \\ &= \underline{\underline{22}} \end{aligned}$$

$$M = \frac{22 \quad (\text{AI})}{(2)}$$

(b) Work out the value of  $n$  when

$$M = 12 \text{ and } x = 4$$

$$\begin{aligned} 12 &= 3 \times 4^2 - n \times 4 \quad (\text{mi}) \\ 12 &= 3 \times 16 - 4n \\ 12 &= 48 - 4n \\ -36 &= -4n \quad (\text{mi}) \\ n &= \frac{-36}{-4} \\ &= \underline{\underline{9}} \end{aligned}$$

$$n = \frac{9 \quad (\text{AI})}{(3)}$$

$$y = 4x - 1$$

Work out the value of  $x$  when  $y = -7$

$$\begin{aligned} -7 &= 4x - 1 \\ 4x - 1 &= -7 \\ 4x &= -6 \end{aligned} \rightarrow \begin{aligned} x &= -\frac{6}{4} \\ &= \underline{\underline{-1.5}} \end{aligned}$$

(m) (A)

$$A = 2x^2 + kx$$

(a)  $x = -3$   
 $k = 4$

Work out the value of  $A$ .

$$\begin{aligned} A &= 2 \times (-3)^2 + 4 \times -3 && \text{(M1)} \\ &= 2 \times 9 - 12 \\ &= 18 - 12 \\ &= \underline{6} \end{aligned}$$

$$A = \frac{6}{(2)} \quad \text{(A1)}$$

(b)  $A = 38$   
 $x = 4$

Work out the value of  $k$ .

$$\begin{aligned} 38 &= 2 \times 4^2 + k \times 4 && \text{(M1)} \\ 38 &= 2 \times 16 + 4k \\ 38 &= 32 + 4k \\ 4k &= 38 - 32 \\ 4k &= 6 && \text{(M1)} \\ k &= \frac{6}{4} \\ &= \frac{3}{2} \quad (= 1.5) \end{aligned}$$

$$k = \frac{1.5}{(3)} \quad \text{(A1)}$$

$$f = 5p - 4v$$

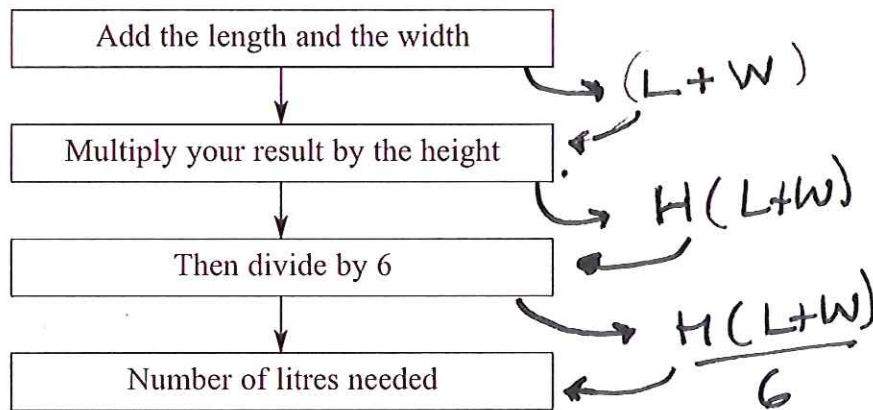
Work out the value of  $p$  when  $f = -22$  and  $v = -5$

$$(-22) = 5 \times p - 4 \times (-5) \quad (M0) \text{ [SUBSTITUTION]}$$

$$p = \frac{-22 - 20}{5} \quad (M1) \text{ [REARRANGEMENT]}$$

$$p = \overset{(A1)}{-8.4}$$

This rule can be used to work out the number of litres of paint needed to cover the walls of a room, using the length, width and height, in metres, of the room.



A room has length  $L$  metres, width  $W$  metres and height  $H$  metres.  $N$  litres of paint are needed to cover the walls of the room.

(a) Find a formula for  $N$  in terms of  $L$ ,  $W$  and  $H$ .

$$N =$$

$$N = \frac{H(L+W)}{6}$$

(3)

*Handwritten annotations: Red circles around (L+W), H, and 6. Red arrows point from these circles to the corresponding parts of the formula.*

The perimeter of the room is  $P$  metres.

(b) Find a formula for  $N$  in terms of  $P$  and  $H$ .

$$P = 2(L+W) \quad \text{(M1)}$$

$$\Rightarrow (L+W) = P \div 2$$

$$\Rightarrow N = \frac{H \times 0.5P}{6}$$

$$= \frac{HP}{12}$$

$$N = \frac{HP}{12} \quad \text{(A1)}$$

(2)

$$Q = 4g^2 - 3h$$

(a) Work out the value of  $Q$  when

$$g = -3 \text{ and } h = 3$$

$$\begin{aligned} Q &= 4 \times (-3)^2 - 3 \times 3 \quad (\text{mi}) \\ &= 4 \times 9 - 9 \end{aligned}$$

$$Q = \frac{27}{1} \quad (\text{AI})$$

(2)

(b) Work out the value of  $h$  when

$$Q = 22 \text{ and } g = 5$$

$$\begin{aligned} 22 &= 4 \times 5^2 - 3h \quad (\text{mi}) \\ 3h &= 4 \times 5^2 - 22 \quad (\text{mi}) \\ 3h &= 78 \quad (\text{mi}) \end{aligned}$$

*either*  $h = \frac{78}{3}$

$$h = \frac{26}{1} \quad (\text{AI})$$

(3)

(c) Make  $g$  the subject of the formula  $Q = 4g^2 - 3h$

$$\begin{aligned} 4g^2 - 3h &= Q \\ 4g^2 &= Q + 3h \quad (\text{mi}) \\ g^2 &= \frac{Q + 3h}{4} \quad (\text{mi}) \end{aligned}$$

$$g = \sqrt{\frac{Q + 3h}{4}} \quad (\text{AI})$$

(3)

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There is no warranty that these solutions will meet Your requirements or provide the results which You want, or that they are complete, or that they are error-free. If You find anything confusing within these solutions then it is Your responsibility to seek clarification from Your teacher, tutor or mentor.

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Sometimes a method used in these solutions might be unfamiliar to You. If You are able to use a different method to obtain the correct answer then You should consider to keep using your existing method and not change to the method that is used here. However, the choice of method is always up to You and it is often useful if You know more than one method to solve a particular type of problem.

Within these solutions there is an indication of where marks **might** be awarded for each question. B marks, M marks and A marks have been used in a similar, but **not identical**, way that an exam board uses these marks within their mark schemes. This slight difference in the use of these marking symbols has been done for simplicity and convenience. Sometimes B marks, M marks and A marks have been interchanged, when compared to an examiners’ mark scheme and sometimes the marks have been awarded for different aspects of a solution when compared to an examiners’ mark scheme.

B1 - This is an unconditional accuracy mark (the specific number, word or phrase must be seen. This type of mark cannot be given as a result of ‘follow through’).

M1 - This is a method mark. Method marks have been shown in places where they might be awarded for the method that is shown. If You use a different method to get a correct answer, then the same number of method marks would be awarded but it is not practical to show all possible methods, and the way in which marks might be awarded for their use, within these particular solutions. When appropriate, You should seek clarity and download the relevant examiner mark scheme from the exam board’s web site.

A1 - These are accuracy marks. Accuracy marks are typically awarded after method marks. If the correct answer is obtained, then You should normally (but not always) expect to be awarded all of the method marks (provided that You have shown a method) and all of the accuracy marks.

Note that some questions contain the words ‘show that’, ‘show your working out’, or similar. These questions require working out to be shown. Failure to show sufficient working out is likely to result in no marks being awarded, even if the final answer is correct.

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