

# 3H

Pearson Edexcel  
International GCSE

# EDEXCEL

# IGCSE

## MATHEMATICS A

# SOLUTIONS

## JANUARY 2014

## 4MA0/3H

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Within these solutions We have indicated where marks **might** be awarded for each question. We have used B marks, M marks and A marks in a similar, but **not identical**, way that the exam board uses these marks within their mark schemes. We have done this for simplicity and convenience. We have sometimes interchanged B marks, M marks and A marks and We have sometimes awarded the marks in different ways to the exam board.

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. We have indicated where method marks might be awarded for the method that is shown. If You use a different method, then the same number of method marks would be awarded but We are not able to indicate for what the marks would be awarded for Your particular method. 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 Your method) and all of the accuracy marks.

Here is a list of the ingredients needed to make leek and potato soup for 6 people.

Leek and Potato Soup
Ingredients for 6 people
900 ml chicken stock
900 ml water
750 g leeks
350 g potatoes
350 g onions

(a) Ainsley wants to make leek and potato soup for 13 people.

Work out the amount of chicken stock he needs.

$$\frac{900}{6} = 150 \text{ (BI)}$$

$$150 \times 13 =$$

$$\underline{\underline{1950}} \text{ (AI)}$$

ml  
(2)

(b) Delia makes leek and potato soup for a group of people.

She uses 1250 g of leeks.

Work out the number of people in the group.

$$\text{(MI)} \quad \frac{1250}{750} = 1.\dot{6}$$

$$1.\dot{6} \times 6 =$$

$$\underline{\underline{10}} \text{ (AI)}$$

A plane flew from Frankfurt to Hong Kong.  
The flight time was 10 hours 45 minutes.  
The average speed was 852 km/h.

→ 10.75 hours  
↑  
(B1)

Work out the distance the plane flew.

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

$$\Rightarrow \text{DISTANCE} = \text{SPEED} \times \text{TIME}$$

$$= 852 \times 10.75 \text{ (M1)}$$

$$= \underline{\underline{9159}} \text{ km (A1)}$$

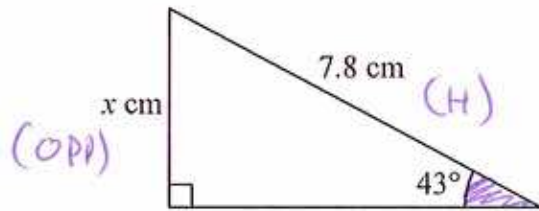


Diagram NOT  
accurately drawn

SOH CAH TOA

Work out the value of  $x$ .  
Give your answer correct to 3 significant figures.

$$\sin 43 = \frac{\text{OPP}}{\text{HYP}}$$

$$\Rightarrow \sin 43 = \frac{x}{7.8} \quad (\text{M1})$$

$$x = 7.8 \times \sin 43 \quad (\text{M1})$$

$$= 5.31958\dots$$

$$x = \underline{5.32} \quad (\text{A1})$$

(a) Write  $2^3 \times 2^4$  as a single power of 2

$$\frac{2^7}{(1)}$$

(1)

(b)  $280 = 2^n \times 5 \times 7$

Find the value of  $n$ .

$$2^n = \frac{280}{5 \times 7}$$
$$\Rightarrow 2^n = 8$$

(m)

$$n = \underline{\underline{3}}$$

$$\frac{n = 3}{(2)}$$

(2)

(a) Simplify  $5c \times 4c$

$$\frac{20c^2}{(1)}$$

(b) Factorise  $4x + x^2$

$$\frac{x(4+x)}{(2)}$$

(c) Work out the value of  $y^3 + 5y$  when  $y = 2$

$$\begin{aligned} 2^3 + 5 \times 2 &= 8 + 10 \\ \text{(M)} &= \underline{\underline{18}} \text{(A)} \end{aligned}$$

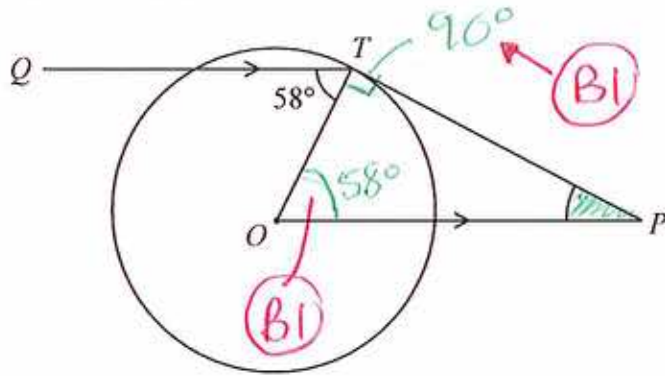


Diagram NOT  
accurately drawn

$T$  is a point on a circle, centre  $O$ .

$Q$  is a point such that angle  $QTO = 58^\circ$

$P$  is the point such that  $OP$  is parallel to  $QT$  and  $PT$  is a tangent to the circle.

Work out the size of angle  $OPT$ .

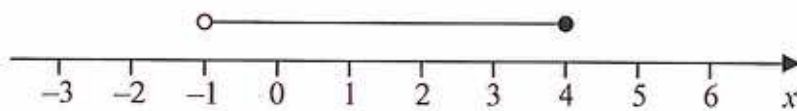


$$180 - (90 + 58)$$

32°

(A)

(a)



An inequality is shown on the number line.

Write down this inequality.

$$\frac{\textcircled{\text{AI}}}{-1 < x \leq 4} \quad \frac{\textcircled{\text{AI}}}{(2)}$$

(b) (i) Solve the inequality  $2(y - 3) \geq 1$

$$2y - 6 \geq 1 \quad \textcircled{\text{MI}}$$

$$2y \geq 7 \quad \textcircled{\text{MI}} \quad \rightarrow \quad y \geq 3.5 \quad \textcircled{\text{AI}}$$

(ii) Write down the lowest integer which satisfies this inequality.

IF  $y \geq 3.5$

THEN  $y = 4, 5, 6, \dots$  (LOWEST = 4)  $\rightarrow$   $\frac{\textcircled{\text{AI}}}{4}$  (4)



A box contains 80 tea bags.

The table shows information about the weight of each tea bag.



MID-VALUE	Weight ( $w$ grams)	Number of tea bags
2.85	$2.8 < w \leq 2.9$	2
2.95	$2.9 < w \leq 3.0$	4
3.05	$3.0 < w \leq 3.1$	22
3.15	$3.1 < w \leq 3.2$	32
3.25	$3.2 < w \leq 3.3$	14
3.35	$3.3 < w \leq 3.4$	6

(a) Work out the percentage of the 80 tea bags that weigh more than 3.1 grams.

$$\frac{32 + 14 + 6}{80} \times 100 \quad (M1)$$

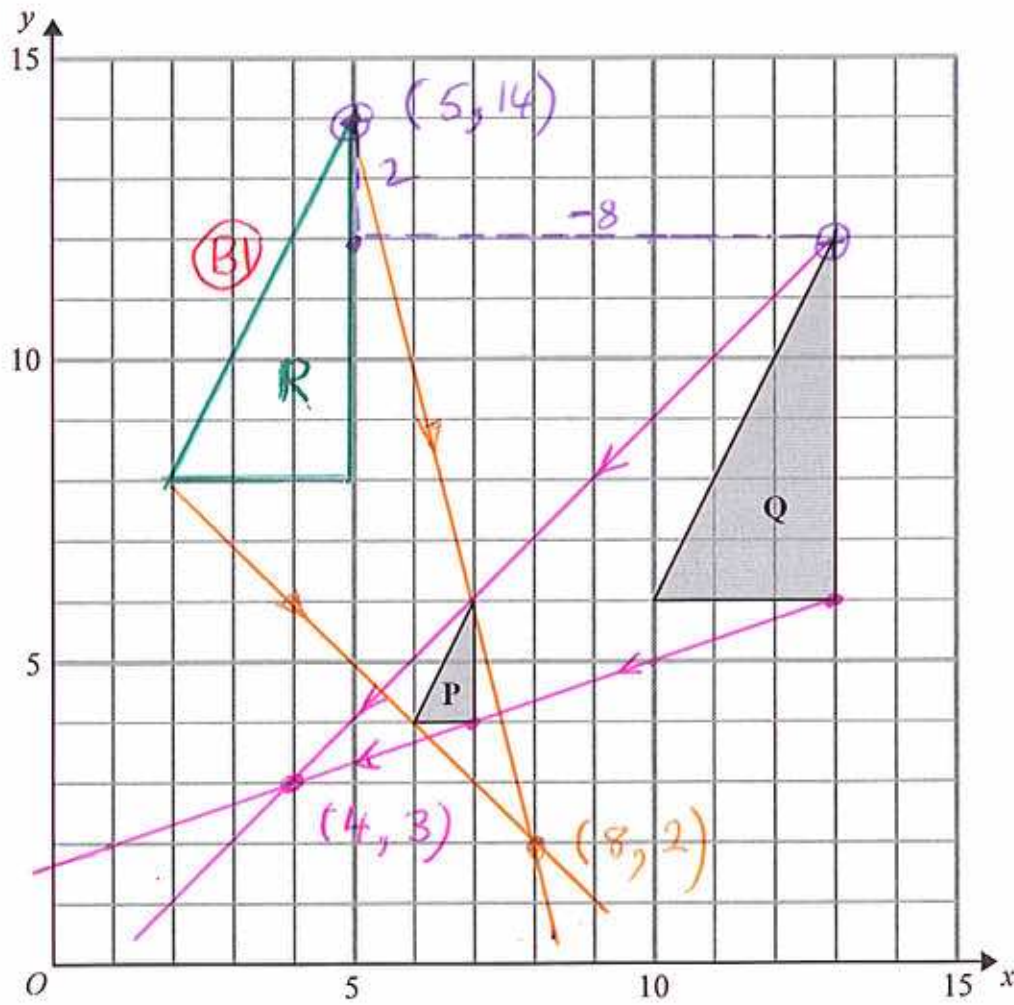
$$\frac{65}{(2)} \% \quad (A1)$$

(b) Work out an estimate for the total weight of the 80 tea bags.

Use halfway values of 2.85 grams, 2.95 grams, ...

$$2 \times 2.85 + 4 \times 2.95 + \dots + 6 \times 3.35 \quad (M1)$$

$$= \underline{\underline{251}} \quad (A1)$$



(a) Describe fully the single transformation which maps triangle P onto triangle Q.

ENLARGEMENT, (BI) SCALE FACTOR = 3 (BI)

CENTRE IS (4, 3) (BI)

(3)

(b) On the grid, translate triangle Q by the vector  $\begin{pmatrix} -8 \\ 2 \end{pmatrix}$

Label the new triangle R.



(1)

(c) Describe fully the single transformation which maps triangle R onto triangle P.

ENLARGEMENT, SCALE FACTOR =  $\frac{1}{3}$  (BI)

CENTRE IS (8, 2) (BI)

(2)

Serena bought a car that had a value of \$16 000

At the end of each year, the value of her car had depreciated by 15%.

Calculate the value of her car at the end of 3 years.

$$16\,000 \times \frac{0.85^3}{(B1)} = \underline{\underline{\$9\,826}} \quad (A1)$$

$\rightarrow 0.85$

$\leftarrow (mis)$

Solve  $\frac{6x-1}{4} - \frac{5-2x}{2} = 1$

Show clear algebraic working.

$$\frac{2(6x-1) - 4(5-2x)}{8} = 1 \quad (m1)$$

$$\frac{12x - 2 - 20 + 8x}{8} = 1 \quad (m1)$$

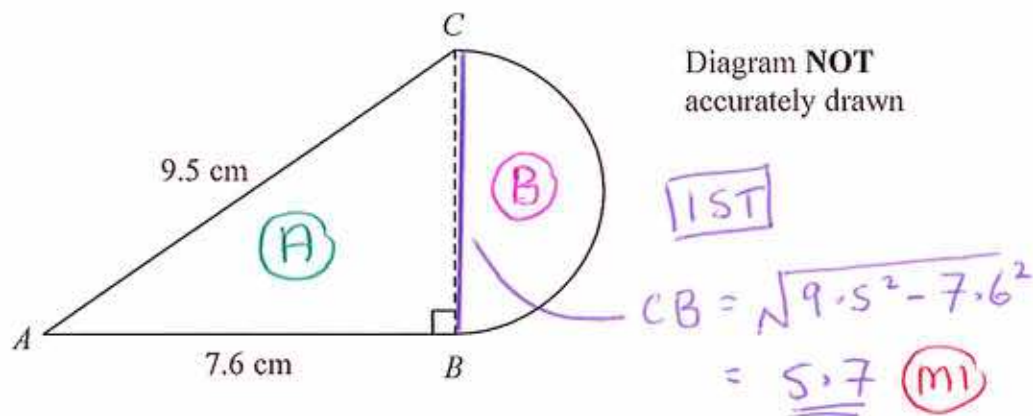
$$\frac{20x - 22}{8} = 1$$

$$20x - 22 = 8 \quad (m1)$$

$$20x = 30$$

$$x = \frac{30}{20}$$

$$= \underline{\underline{1.5}} \quad (A1)$$



The diagram shows a shape made from triangle  $ABC$  and a semicircle with diameter  $BC$ . Triangle  $ABC$  is right-angled at  $B$ .  $AB = 7.6$  cm and  $AC = 9.5$  cm.

Calculate the area of the shape.  
Give your answer correct to 3 significant figures.

$$(A) = \frac{7.6 \times 5.7}{2} = \underline{21.66} \text{ (A)}$$

$$(B) = \frac{\pi \times 2.85^2}{2} = \underline{12.758\dots} \text{ (A)}$$

$$\begin{aligned} \text{TOTAL} &= 21.66 + 12.758\dots \\ &= 34.4187\dots \\ &= \underline{\underline{34.4 \text{ cm}^2}} \text{ (A)} \end{aligned}$$

A box contains 20 nails.

The table shows information about the length of each nail.

Length of nail (mm)	25	30	40	50	60
Number of nails	1	8	4	5	2



(a) Viraj takes at random one nail from the box.

Find the probability that the length of the nail he takes is

(i) 50 mm or 60 mm,

$$\text{(M1)} \quad \frac{5+2}{20} = \frac{7}{20}$$

$$\text{(A1)} \quad \underline{0.35}$$

(ii) less than 35 mm.

$$\text{(M1)} \quad \frac{1+8}{20} = \frac{9}{20}$$

$$\text{(A1)} \quad \underline{0.45}$$

(4)

(b) Jamila puts all 20 nails into a bag.

She takes at random one of the nails and records its length.

She **replaces** the nail in the bag.

She then takes at random a second nail from the bag and records its length.

Calculate the probability that the two nails she takes

(i) each have a length of 60 mm,

$$P(60,60) = \frac{2}{20} \times \frac{2}{20} \quad \text{(M1)}$$

$$\text{(A1)} \quad \underline{0.01}$$

(ii) have a total length of 80 mm.

$$\begin{aligned} P(40,40) &= \frac{4}{20} \times \frac{4}{20} = \frac{16}{400} \\ P(30,50) &= \frac{8}{20} \times \frac{5}{20} = \frac{40}{400} \\ P(50,30) &= \frac{5}{20} \times \frac{8}{20} = \frac{40}{400} \end{aligned} \quad \left. \begin{array}{l} \text{(M1) [MULTIPLY]} \\ \text{total} = \frac{96}{400} \\ \text{(A1)} \\ = \underline{\underline{0.24}} \end{array} \right\}$$

$$\text{(M1) [THREE POSSIBILITIES]}$$

$D$  is directly proportional to  $t^2$   
 When  $t = 4$ ,  $D = 8$

(a) Find a formula for  $D$  in terms of  $t$ .

$$D = k \times t^2 \quad (t=4, D=8)$$

$$8 = k \times 4^2 \quad (m)$$

$$\Rightarrow k = \frac{8}{4^2} = \underline{\underline{0.5}} \quad (m)$$

$$D = 0.5t^2 \quad (A)$$

(3)

(b) Find the positive value of  $t$  when  $D = 50$

$$D = 0.5t^2 \quad (D=50)$$

$$50 = 0.5t^2$$

$$t^2 = \frac{50}{0.5} \quad (m)$$

$$t = \sqrt{\frac{50}{0.5}}$$

$$t = \underline{\underline{10}} \quad (A)$$

(2)

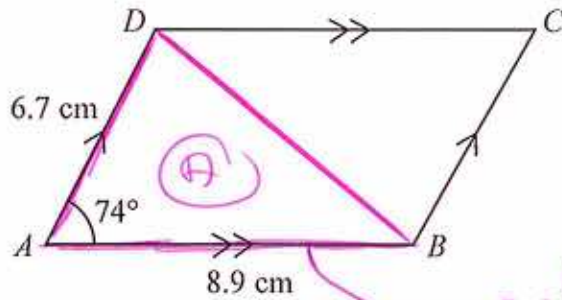


Diagram **NOT**  
accurately drawn

$ABCD$  is a parallelogram.

$AB = 8.9$  cm.

$AD = 6.7$  cm.

Angle  $BAD = 74^\circ$

Calculate the area of parallelogram  $ABCD$ .

Give your answer correct to 3 significant figures.

$$\begin{aligned} \textcircled{A} &= \frac{1}{2} \times 8.9 \times 6.7 \times \sin 74 \quad \textcircled{m1} \\ &= \underline{\underline{28.66}} \quad \textcircled{A1} \end{aligned}$$

$$\begin{aligned} \therefore \text{WHOLE PARALLELOGRAM} &= 28.66 \times 2 \\ &= 57.32 \\ &= \underline{\underline{57.3}} \text{ cm}^2 \quad \textcircled{A1} \end{aligned}$$



Given that  $y$  is positive, make  $y$  the subject of  $y = \sqrt{ay^2 + n}$

Show clear algebraic working.

$$y^2 = ay^2 + n \quad (M1) \text{ [SQUARING]}$$

$$y^2 - ay^2 = n \quad (M1) \text{ [Y-TERMS BOTH ON LEFT]}$$

$$y^2(1-a) = n \quad (M1) \text{ [FACTORISE]}$$

$$y^2 = \frac{n}{1-a} \quad (M1) \text{ [DIVIDE BY FACTOR]}$$

$$\underline{\underline{y = \sqrt{\frac{n}{1-a}}}} \quad (M1) \text{ SQUARE ROOT}$$

Given that  $(5 - \sqrt{x})^2 = y - 20\sqrt{2}$  where  $x$  and  $y$  are positive integers, find the value of  $x$  and the value of  $y$ .

$$\begin{aligned}(5 - \sqrt{x})(5 - \sqrt{x}) &= 25 - 5\sqrt{x} - 5\sqrt{x} + x \\ &= 25 - 10\sqrt{x} + x \\ &= (25 + x) - 10\sqrt{x} \quad \text{(m)}\end{aligned}$$

$$y = 25 + x$$

$$\begin{aligned}10\sqrt{x} &= 20\sqrt{2} \\ &= 10 \times 2\sqrt{2} \\ &= 10 \times \sqrt{8}\end{aligned}$$

$$\therefore x = \underline{\underline{8}} \quad \text{(A)}$$

$$\begin{aligned}y &= 25 + 8 \\ &= \underline{\underline{23}} \quad \text{(A)}\end{aligned}$$

(a)  $x = 9 \times 10^{2m}$  where  $m$  is an integer.

Find, in standard form, an expression for  $\sqrt{x}$

$$\begin{aligned}\sqrt{x} &= \sqrt{9 \times 10^{2m}} \\ &= \sqrt{9} \times \sqrt{10^{2m}} &= 3 \times (10^{2m})^{\frac{1}{2}} \\ & &= \underline{3 \times 10^m} \quad \text{(M1)} \quad \text{(A1)}\end{aligned}$$

(b)  $y = 9 \times 10^{2n}$  where  $n$  is an integer.

Find, in standard form, an expression for  $y^{\frac{3}{2}}$


Give your answer as simply as possible.

$$\begin{aligned}y &= 9 \times 10^{2n} \\ y^{\frac{3}{2}} &= (9 \times 10^{2n})^{\frac{3}{2}} \\ &= 9^{\frac{3}{2}} \times 10^{2n \times \frac{3}{2}} \\ &= \underline{3 \times 10^n} \\ \therefore y^{\frac{3}{2}} &= (3 \times 10^n)^3 \quad \text{(M1)} \\ &= 3^3 \times 10^{n \times 3} \\ &= 27 \times 10^{3n} \\ &= \underline{2.7 \times 10^{3n+1}} \quad \text{(A1)}\end{aligned}$$

Factorise completely  $(12x - y)^2 - (4x - 3y)^2$ 

DOTS

$$\begin{aligned} & [(12x - y) + (4x - 3y)] \times [(12x - y) - (4x - 3y)] \\ &= [16x - 4y] \quad \times \quad [8x + 2y] \\ &= 4(4x - y) \quad \times \quad 2(4x + y) \\ &= 8(4x - y)(4x + y) \end{aligned}$$

(A)  (A)

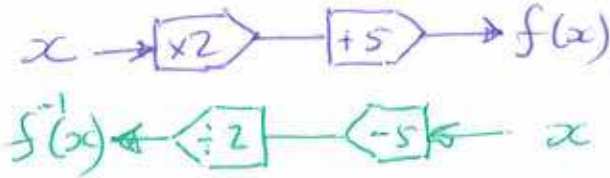
f is the function  $f(x) = 2x + 5$

(a) Find  $f(3)$

$$f(3) = 2 \times 3 + 5$$

$$\frac{11}{(1)} \quad \text{(A1)}$$

(b) Express the inverse function  $f^{-1}$  in the form  $f^{-1}(x) =$



$$f^{-1}(x) = \frac{x-5}{2} \quad \text{(A2)}$$

(2)

g is the function  $g(x) = x^2 - 25$

(c) Find  $g(-3)$

$$(-3)^2 - 25$$

$$\frac{-16}{(1)} \quad \text{(A1)}$$

(d) (i) Find  $gf(x)$

Give your answer as simply as possible.

$$\begin{aligned} gf(x) &= (2x+5)^2 - 25 \quad \text{(M1)} \\ &= (2x+5)(2x+5) - 25 \\ &= 4x^2 + 10x + 10x + 25 - 25 \quad \text{(M1)} \\ &\quad \text{F} \quad \text{O} \quad \text{I} \quad \text{L} \end{aligned}$$

$$gf(x) = 4x^2 + 20x \quad \text{(A1)}$$

(ii) Solve  $gf(x) = 0$

$$4x(x+5) = 0 \quad \text{(M1)}$$

$$[ \text{OR } 4x(x+5) ]$$

$$\begin{aligned} \swarrow \\ 4x &= 0 \\ x &= \underline{\underline{0}} \end{aligned}$$

$$\begin{aligned} \searrow \\ x+5 &= 0 \\ x &= \underline{\underline{-5}} \quad \text{(A1) BOTH} \end{aligned}$$

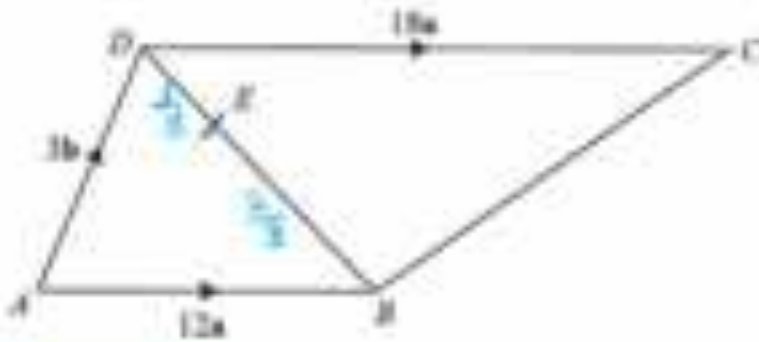


Diagram NOT accurately drawn

ABCD is a parallelogram.

AB is parallel to DC.

$$\vec{AB} = 12a$$

$$\vec{AD} = 3b$$

$$\vec{DC} = 18a$$

E is the point on the diagonal DB such that  $DE = \frac{1}{3} DB$

(a) Find, in terms of a and b,

$$\begin{aligned} \text{(i) } \vec{DB} &= \vec{DA} + \vec{AB} \\ &= -3b + 12a \end{aligned}$$

(A1) (ft)(ft)(ft)

$$12a - 3b = 3(4a - b)$$

$$\text{(ii) } \vec{DE} = \frac{1}{3} \vec{DB} = \frac{1}{3} \times 3(4a - b)$$

(A1)

$$4a - b$$

$$\begin{aligned} \text{(iii) } \vec{AE} &= \vec{AD} + \vec{DE} \\ &= 3b + (4a - b) \end{aligned}$$

(A1) (ft)(ft)(ft)

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

(ft)

(b) Show by a vector method that BC is parallel to AE.

$$\begin{aligned}\vec{BC} &= \vec{BA} + \vec{AD} + \vec{DC} \\ &= -12a + 3b + 18a \\ &= 6a + 3b \\ &= \underline{\underline{3(2a+b)}} \quad (3M)\end{aligned}$$

COMPARE THIS TO  $\vec{AE}$

$$\vec{AE} = 2(2a+b)$$

BOTH VECTORS ARE A MULTIPLE OF  $2a+b$  SO THEY ARE PARALLEL } (1M)

[ANY EQUIVALENT STATEMENT]