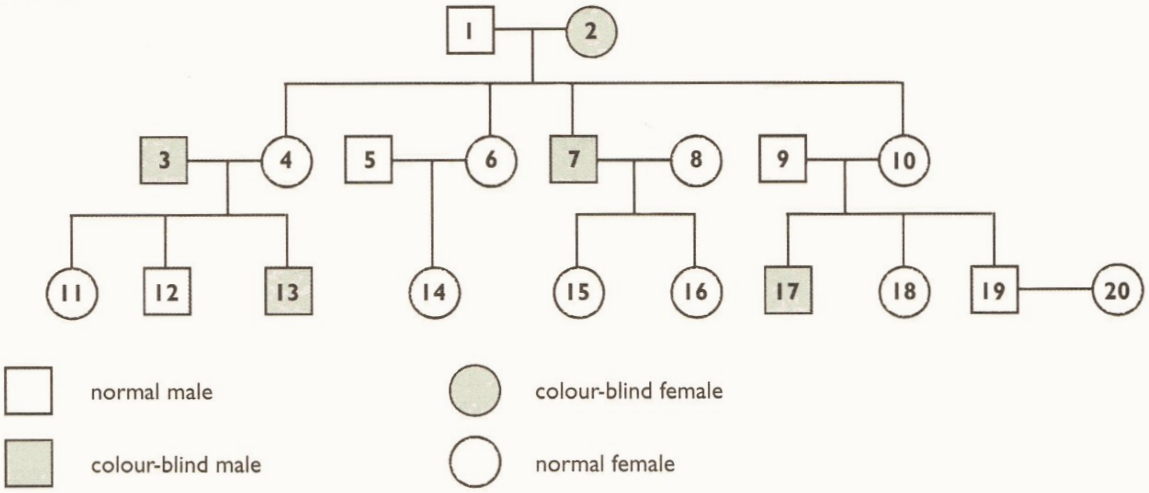
6 A breed of domestic chickens can have black, grey or white feathers. These colours are produced by two alleles, C^B and C^W.

a Write down the genotypes that produce black, grey and white feathers. [2]

b Explain why the alleles are written in this way, rather than as a capital letter for one allele and a small letter for the other. [2]

c A cockerel with grey feathers was mated with a hen with white feathers.
Draw a complete genetic diagram to predict the ratio of the different colours of chicks that will be produced. [5]

S 7 The diagram shows a pedigree chart for a family in which some of the members are red–green colour-blind.



a Explain how the pedigree supports the idea that red–green colour blindness is a sex-linked characteristic. [2]

b Using the symbols X^B for the allele for normal vision, and X^b for the allele for colour blindness, state the genotypes of each of the following individuals. If there is more than one possible genotype, write down both of them.
2, 3, 11, 13, 19 [5]

c If individuals 3 and 4 have another son, what is the probability that he will be colour-blind? Use a genetic diagram to explain your answer. [5]

d Explain why a colour-blind man cannot pass on this condition to his son. [2]

8 Two women gave birth in the same hospital on the same afternoon. Their babies were taken away, and then brought back to them one hour later. One of the women was worried that she had been given the wrong baby. She asked for blood tests to be carried out. The hospital found that she was group A and her husband was group O. The other mother was group AB and her husband was group A. The woman with blood group A had been given the baby with blood group O. The woman with group AB was given the baby with blood group B. Use genetic diagrams to determine whether the women had been given the right babies. [8]

S 5 Reed warblers are small birds that migrate over long distances between western Africa and northern Europe.

The photograph below shows a reed warbler, *Acrocephalus scirpaceus*.

a State three characteristic features of birds that are visible in the photograph. [3]

A study was carried out in Sweden into the effects of natural selection on wing length in reed warblers.

The wings of young reed warblers reach their maximum length a few days after leaving the nest.

At this age the wing length in millimetres of each bird was recorded. Each bird was identified by putting a small ring around one of its legs.

When the birds were caught in net traps as adults, the information on the rings was used to identify specific birds and their ages.

The length of time between ringing and trapping was recorded for each bird that was identified before it was released.

The mean age at trapping was calculated for birds with each wing length.

The results are shown in the table opposite.

Wing length at ringing / mm	Number of birds trapped	Mean age at trapping / days
63 or less	24	253
64	72	256
65	130	297
66	183	346
67	167	349
68	106	270
69	66	237
70 or more	23	199
	total = 771	

b i Explain why wing length is an example of continuous variation. [2]

ii Suggest a feature of reed warblers, **other than wing length**, that shows continuous variation. [1]

c The researchers concluded that reed warblers with a wing length of 66–67 mm had the best chance of survival.

i Describe the evidence from the table that supports this conclusion. [4]

ii The researchers also suggested that more evidence was needed to make this conclusion.

Suggest what other evidence would show that birds with wings 66–67 mm in length have the best chance of survival. [3]

d Scientists have discovered that genes are responsible for wing length in reed warblers. The most common length of wing has been 66–67 mm for many generations of these birds.

Explain how natural selection may be responsible for maintaining the mean wing length of reed warblers at 66–67 mm. [4]

[Adaptd from Cambridge IGCSE® Biology 0610/32, Question 5, October/November 2011]

Biology Test 18/11/2018 Marks Scheme

Question number 5:

a) beak; feathers; wings; [3]

b) there are no distinct categories; individuals can have any wing length within the range from 63 or less to 70 or more; [2]

ii. for example: body mass / body length / beak length; [1]

c)

i. the largest number of birds trapped has wing lengths of 66 or 67 cm; suggesting that most birds had these wing lengths; comparative data quoted for birds with these wing lengths and others; birds with these wing lengths had greater mean ages when trapped; suggesting that they lived longer than others; comparative age data quoted for birds with these wing lengths and others; [max 4]

iii. repeat measurements for a larger number of birds; repeat in countries other than Sweden; check wing lengths of birds that are breeding; follow individual marked birds throughout their lives to measure wing length and length of life; measure the wing length of dead birds; [max 3]

d) birds with this wing length survive for longer; more likely to reproduce; than birds with smaller wings; wing length determined by, genes / alleles; which are passed on to off spring;

1 A teacher added some of the Group 1 elements to separate samples of water.

(a) State two observations that could be made when a small piece of sodium is added to a large trough containing water.

(2)

1 .....

.....

2 .....

.....

(b) In another experiment she added a small piece of a different Group 1 element and noticed that the reaction was less vigorous.

Which element did she add in this experiment?

(1)

.....

(c) In another experiment she added a small piece of potassium to a large trough containing water. This time she observed a lilac flame.

(i) Identify the gas that burned.

(1)

.....

(ii) Give the formula of the ion that caused the flame to be lilac.

(1)

.....

(d) When the Group 1 elements react with water, each of their atoms loses an electron from its outer shell. For sodium and potassium, these processes can be represented by the equations

- $Na \rightarrow Na^+ + e^-$
- $K \rightarrow K^+ + e^-$

Explain, by referring to the electronic configurations of sodium and potassium, why potassium is more reactive than sodium.

(4)

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.....

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.....

(Total for Question 1 = 9 marks)

2 The table shows some properties of four substances A, B, C and D.

Substance	Melting point in °C	Boiling point in °C	Conducts electricity when solid?	Conducts electricity when molten?
A	–101	–35	no	no
B	1063	2970	yes	yes
C	801	1413	no	yes
D	3550	4830	no	no

(a) Use the information in the table to identify the substance that

(i) is a metal

(1)

☒ **A** ☒ **B** ☒ **C** ☒ **D**

(ii) could be diamond

(1)

☒ **A** ☒ **B** ☒ **C** ☒ **D**

(iii) is a gas at 20 °C

(1)

☒ **A** ☒ **B** ☒ **C** ☒ **D**

(iv) contains oppositely charged ions

(1)

☒ **A** ☒ **B** ☒ **C** ☒ **D**

(b) Some of the substances in the table are compounds.

What is meant by the term **compound**?

(2)

.....

.....

.....

.....

(c) (i) The electronic configurations of atoms of sodium and chlorine are

Na 2.8.1

Cl 2.8.7

Describe the changes in the electronic configurations of sodium and chlorine when these atoms form sodium chloride.

(3)

.....

.....

.....

.....

.....

.....

(ii) Calculate the relative formula mass of sodium chloride (NaCl).

Use the Periodic Table on page 2 to help you.

(2)

relative formula mass = ...

(Total for Question 2 = 11 marks)

Question number	Answer	Notes	Marks
1 (a)	bubbles / fizzing / effervescence sodium moves / darts / floats sodium gets smaller / disappears sodium melts / forms ball white trail	Accept gas given off/evolved/formed/produced Accept hydrogen gas Ignore identity of gas Accept equivalents such as shoots/skims Accept dissolves Do not apply list principle Assume that it = sodium Ignore flames / sparks Any two for 1 each	2
(b)	Do not apply list principle	Assume that it = sodium	1
(c) i	hydrogen / H_2	Ignore H	1
ii	K^+		1

Question number	Answer	Notes	Marks
1 (d)	Na is 2.8.1 K is 2.8.8.1	Accept other punctuation and no punctuation and diagrams in place of full stops If neither of M1 and M2 scored, allow potassium has more (electron) shells (or numbers of shells stated)/energy levels for 1 mark?	1 1
	outer/valence electron / outer shell / electron lost in K further from nucleus/protons	Ignore potassium further from nucleus	1
	less attracted by nucleus	Accept (electron) more easily removed/lost /less energy needed to remove (electron) Accept potassium more willing to lose electron If no reference to nucleus or protons, then neither M3 nor M4 can be awarded A correct reference to nucleus/protons is needed before M3 and M4 can be awarded Ignore references to shielding Accept reverse arguments for sodium in M3 and M4	1
		Total	**9**

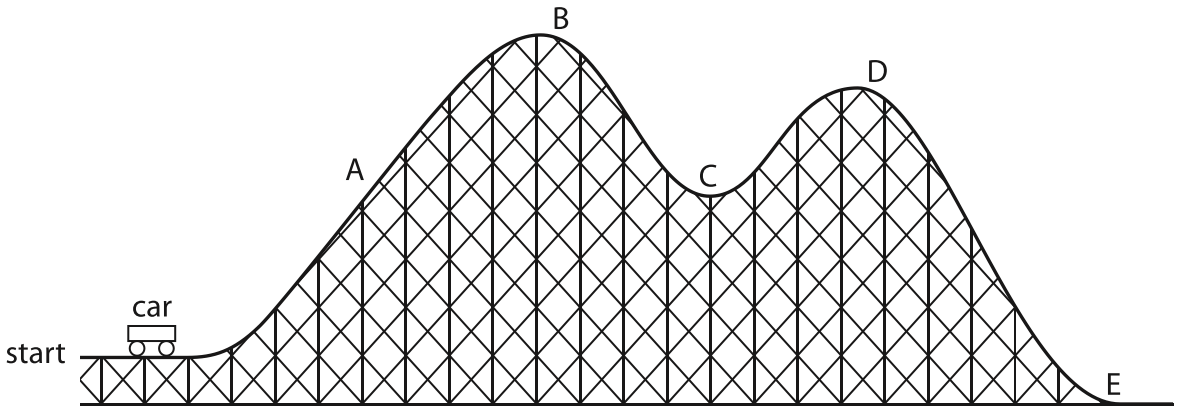
Question number	Answer	Accept	Reject	Marks
2 (a) (i)	B	lower case letters		1
(ii)	D			1
(iii)	A			1
(iv)	C			1
(b)	**M1 -** (a substance) containing (two or more) elements IGNORE atoms for **M1** only		mixture for M1 only	1
			molecules/particles bonded, etc for M1 and M2	1
	M2 – bonded (together) /chemically combined (in a fixed ratio)	chemically joined		
(c) (i)	**M1** - Na loses electron(s)			1
	M2 – Cl gains electron(s)			1
	M3 – Na becomes 2.8 AND chlorine becomes 2.8.8			1
	If incorrect number of electrons transferred, max 2			
	IGNORE references to full shells			
	max 1 for mention of covalent bonding			
	All 3 marks can be scored from correct dot and cross diagrams showing electron transfer			

NaCl
23 + 35.5
= 58.5 g/mol

Answer ALL questions.

1 The diagram shows a roller-coaster ride.

The car is pulled slowly from the start to point B and then released.



(a) Choose letters from the diagram to complete this sentence. **(2)**

The car has the most gravitational potential energy at point ..... B .....

and it goes fastest at point ..... E ..... .

(b) The mass of the car is 900 kg.

The maximum speed of the car is 15 m/s.

(i) State the relationship between momentum, mass and velocity. **(1)**

momentum = mass x velocity

$P = mv$

(ii) Calculate the maximum momentum of the car.

Give the unit. **(3)**

$Force = \frac{\Delta P}{t}$ $\quad 900 \times 15$ $\quad kg\ m/s$

$\Delta P = Force \times time$

$N \quad s$

maximum momentum = ... 13500 ..... unit ..... $kg\ ms^{-1}$ ..... Ns

$\frac{1}{2}bh = \frac{1}{2} \times P = \frac{1}{2} \times mv = \frac{1}{2}mv^2$

(iii) State the equation linking kinetic energy (KE), mass and speed.

(1)

$KE = \frac{1}{2}mv^2 = \frac{1}{2} \times \text{mass} \times \text{velocity}^2$

$Ns \times \frac{m}{s}$

(iv) Calculate the maximum KE of the car.

(2)

$KE_{max} = \frac{1}{2}mv_{max}^2$

$= \frac{1}{2} \times 900 \times 15^2$

$= 101250 \text{ J}$

maximum KE = 101250 J

(Total for Question 1 = 9 marks)

The table gives some measurements about a raindrop.

mass of raindrop	0.000 035 kg
distance raindrop falls	1200 m
speed of raindrop as it hits the ground	8.8 m/s

(a) (i) State the relationship between momentum, mass and velocity.

momentum = mass x velocity (1)

(ii) Calculate the momentum of the raindrop as it hits the ground.

Give the unit.

0 000 035 x 8 8 (3)

momentum = 3.08×10^{-4} unit kg ms^{-1} / Ns

(b) (i) State the equation linking gravitational potential energy, mass, *g* and height.

Gravitational potetial energy = mgh
= mass x g x height (1)

(ii) Calculate the change in gravitational potential energy (GPE), when the raindrop falls 1200 m above the ground.

GPE = 0 000 035 x 1200 x 98 (2)

GPE = 04116 J

(iii) State the kinetic energy (KE) of the raindrop as it hits the ground.
[assume no energy losses]

(1)

KE = 04116 J

(c) (i) State the equation linking kinetic energy, mass and speed.

(1)

$KE = \frac{1}{2} \times mass \times speed^2$

(ii) Show that the speed of the raindrop as it hits the ground would be about 150 m/s. [assume no energy losses]

(3)

$\frac{1}{2} \times 0.000\,035 \times V^2 = 0.4116$

$V^2 = \frac{0.4116}{\frac{1}{2} \times 0.000\,035} = 154$ m/s

(iii) Explain why the actual speed of the raindrop as it hits the ground is much less than 150 m/s.

(2)

(I) Energy lost due to travel against air resistance, work done

(II) The rain drops (acceleration) would be balanced by upthrust of air, reaches terminal velocity so it would not reach about 150 m/s

(Total for this question = 14 marks)

1. Let vectors $\overrightarrow{AB} = \begin{pmatrix} 1 & 0 \\ 0 & 4 \end{pmatrix}$ and $\overrightarrow{CA} = \begin{pmatrix} 1 & 3 \\ 0 & 0 \end{pmatrix}$

a) What is $2\overrightarrow{AB}$?

$2\overrightarrow{AB} = 2\begin{pmatrix} 1 \\ 4 \end{pmatrix} = \begin{pmatrix} 2 \\ 8 \end{pmatrix}$ (2)

b) What is $\overrightarrow{AB} + \overrightarrow{CA}$?

$\begin{pmatrix} 1 \\ 4 \end{pmatrix} + \begin{pmatrix} 1 \\ -8 \end{pmatrix} = \begin{pmatrix} 1+1 \\ 4+(-8) \end{pmatrix} = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$ (2)

c) What is $\overrightarrow{BC}$?

$\overrightarrow{BC} = \overrightarrow{BA} + \overrightarrow{AC}$

$= -\overrightarrow{AB} - \overrightarrow{CA}$

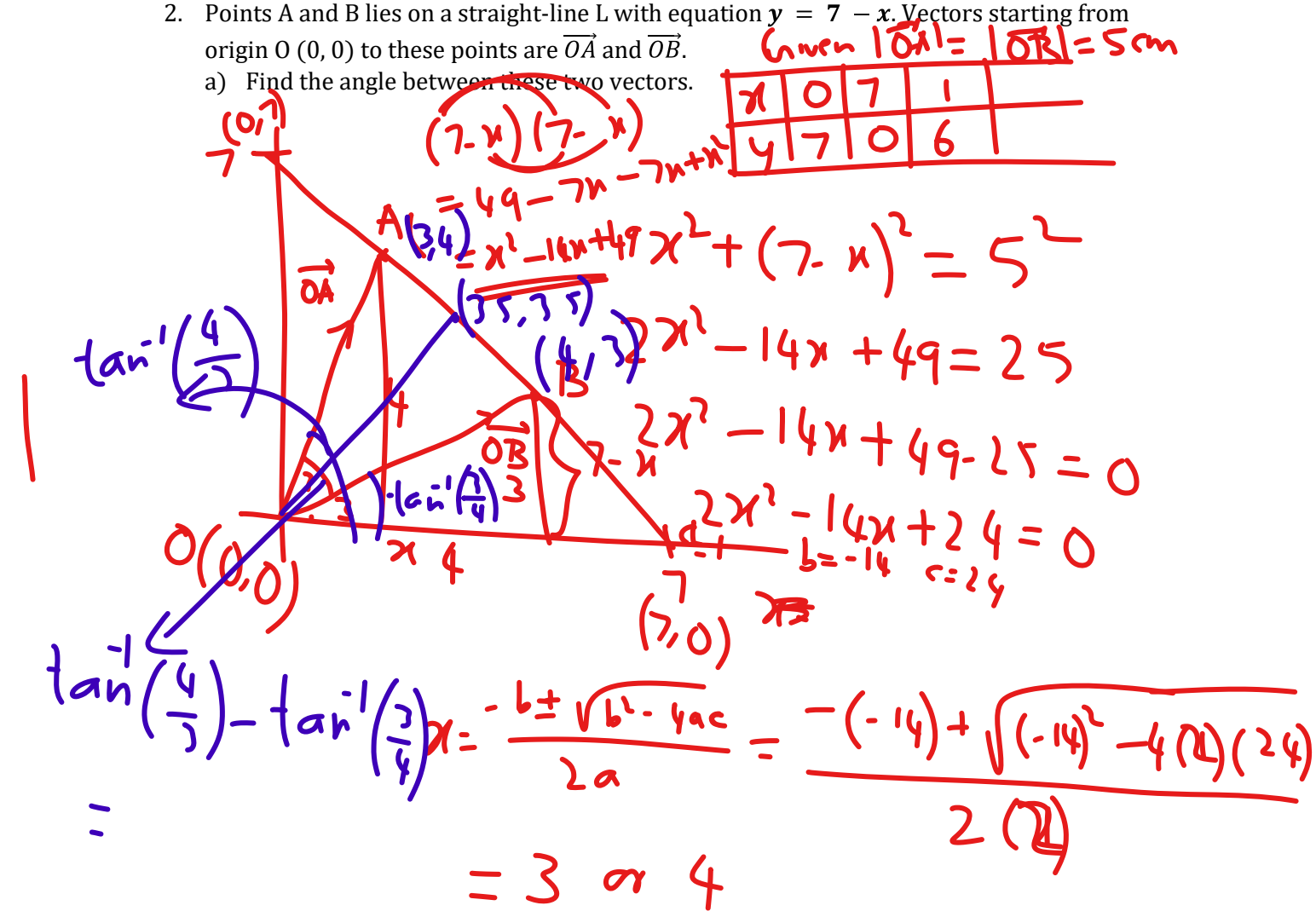
$= -\begin{pmatrix} 1 \\ 4 \end{pmatrix} - \begin{pmatrix} 1 \\ -8 \end{pmatrix}$

$= \begin{pmatrix} -1 \\ -4 \end{pmatrix} + \begin{pmatrix} -1 \\ 8 \end{pmatrix} = \begin{pmatrix} (-1)+(-1) \\ -4+8 \end{pmatrix}$

$= \begin{pmatrix} -2 \\ 4 \end{pmatrix}$

2. Points A and B lies on a straight-line L with equation $\boldsymbol{y = 7 - x}$. Vectors starting from origin O (0, 0) to these points are $\overrightarrow{OA}$ and $\overrightarrow{OB}$.

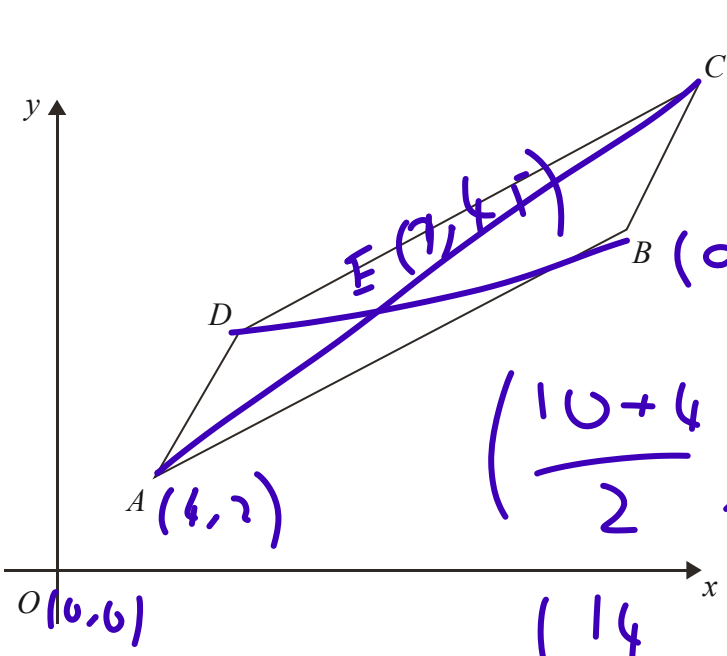
a) Find the angle between these two vectors.



Vector $\overrightarrow{OC}$ bisects the angle between $\overrightarrow{OA}$ ans $\overrightarrow{OB}$ and point C also lies on the line L.

b) Express $\overrightarrow{OC}$ in the form $\begin{pmatrix} j \\ k \end{pmatrix}$

3 Here is the parallelogram $ABCD$.



$\overrightarrow{AD} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$, $\overrightarrow{AB} = \begin{pmatrix} 5 \\ 3 \end{pmatrix}$

(a) Find the magnitude of $\overrightarrow{AD}$.

Give your answer correct to 3 significant figures.

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(2)

The point A has coordinates (4, 2)

(b) Work out the coordinates of the point C.

(10, 7)

(3)

The diagonals of the parallelogram $ABCD$ cross at the point E.

(c) Find as a column vector, $\overrightarrow{OE}$.

$\begin{pmatrix} 7 \\ 4\frac{1}{2} \end{pmatrix}$

.....

(3)

(Total for Question 15 is 8 marks)

Do NOT write in this space.