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A grey silhouette of a Pegasus, a mythical winged horse, standing on a base. The Pegasus is facing left and has its wings spread. Behind it are two stylized, pointed structures resembling towers or spires.

CFE National 5 Resource

Unit 3

Applications

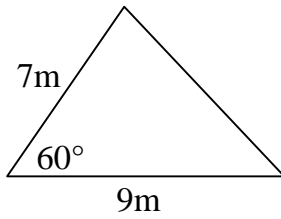
Homework Exercises

- ❖ **Homework exercises covering all the Unit 3 topics**
- ❖ **+ Answers**
- ❖ **+ Marking Schemes**

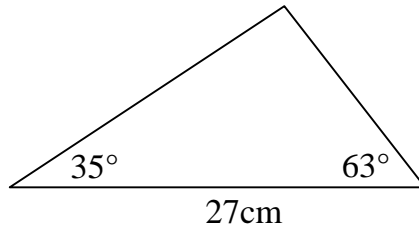
National 5 Homework – Applications

TRIGONOMETRY (1) – AREA of TRIANGLE, SINE RULE and COSINE RULE

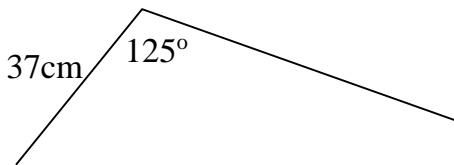
1. Calculate the area of the triangle in the diagram. (2)



2. Calculate the length of the shortest side in the triangle shown. (4)



3. A metal rod 82cm long is bent to form an angle of 125° at a point 37cm from one end. How far apart are the two ends of the rod now? (4)



4. The three sides of a triangle are 11·2cm, 14·3cm and 20·4cm. Calculate the size of the largest angle in the triangle. (4)

14 marks

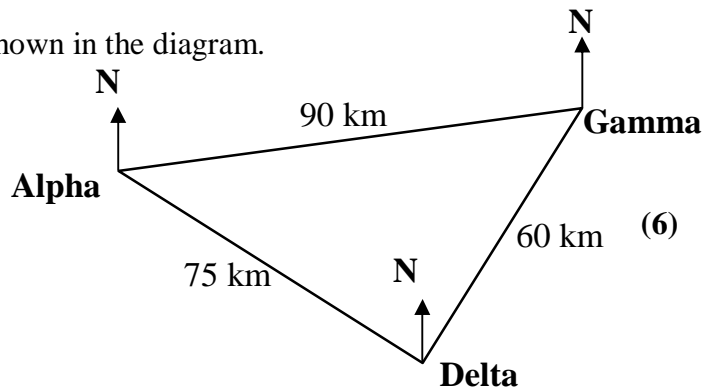
National 5 Homework – Applications

TRIGONOMETRY (2) – PROBLEMS

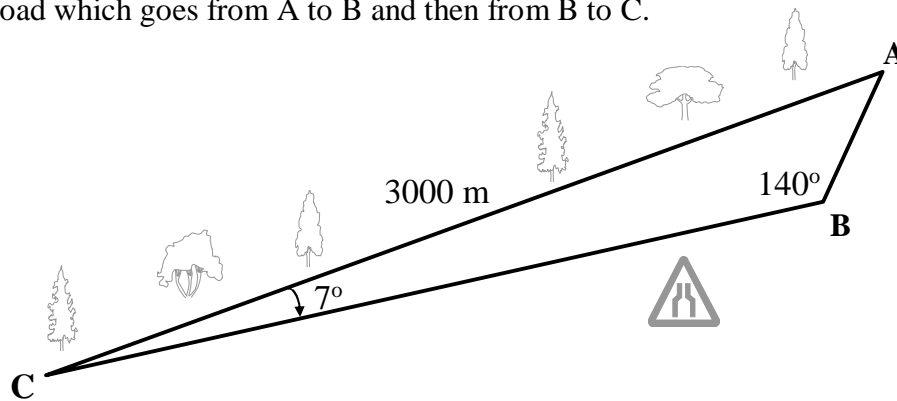
1. Three oil platforms, Alpha, Gamma and Delta are situated in the North Sea as shown in the diagram.

The distances between the oil platforms are shown in the diagram.

If the bearing of Delta from Alpha is 125° , what is the bearing of Gamma from Alpha?

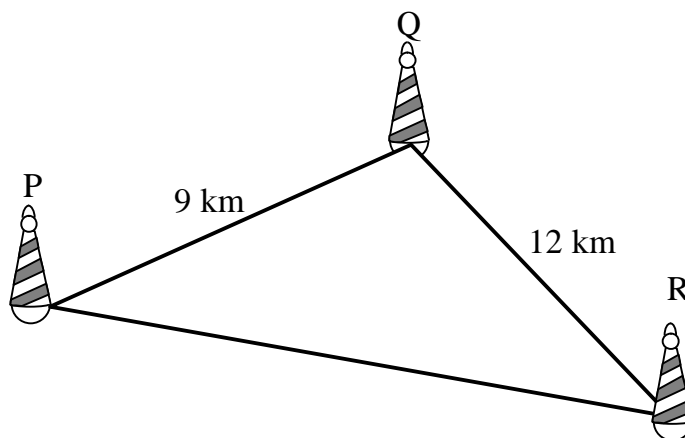


2. On an orienteering course, Ian follows the direct route through a forest from A to C while Kate follows the road which goes from A to B and then from B to C.



Calculate the total distance which Kate has to travel from A to C.

3. A small boat race travels round a set of three buoys to cover a total distance 35 km.



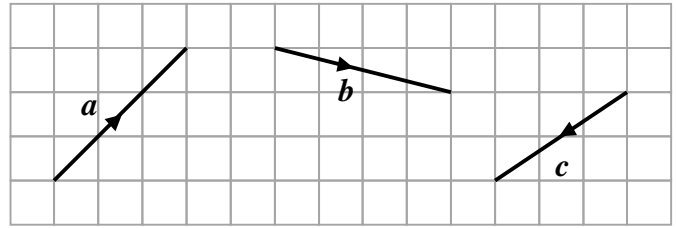
- (a) Calculate the size of angle PQR. (b) Calculate the area of triangle PQR. (6)

20 marks

National 5 Homework – Applications

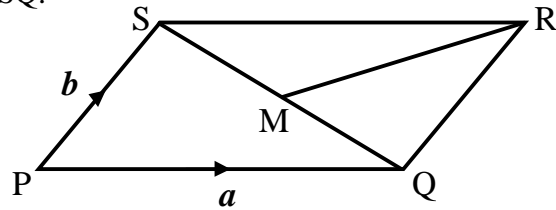
WORKING with VECTORS

1. The diagram shows 3 vectors a , b and c .



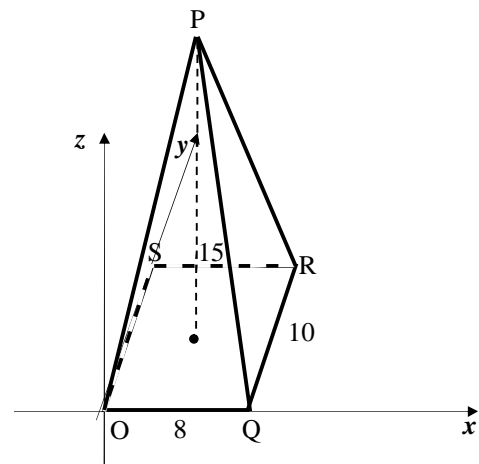
- (a) Write down the components of vectors a , b and c (3)
- (b) Draw diagrams on squared paper to represent:
- (i) $a + b$ (ii) $a - c$ (iii) $b + c$
- (iv) $(a + b) + c$ (v) $a + (b - c)$ (9)
- (c) For the resultant vectors in (i) and (iii) from part (b), state the components and calculate its magnitude correct to one decimal place. (4)

2. PQRS is a parallelogram. \vec{PQ} is represented by vector a and \vec{PS} is represented by vector b as shown in the diagram. M is the mid-point of SQ.



- Express, in terms of a and b : (a) \vec{PR} (b) \vec{SQ} (c) \vec{SM} (6)

3. State the coordinates of each vertex of the rectangular based pyramid shown in the diagram. (4)



- 4 Two forces are acting on an object.

They are represented by the vectors $F_1 = 3i + j - k$ and $F_2 = i + 3j$.

- Find the components and magnitude of the resultant force $F_1 + F_2$. (4)

30 marks

National 5 Homework – Applications

WORKING with PERCENTAGES

1. John has just put £700 into a savings account where the rate of interest is 4% per annum.
How much will his savings be worth after 3 years? (3)

2. Mary puts £1200 into an account where the annual rate of interest is 5.5%.
How long will it be before she has at least £1400 in her account? (5)

3. My new car has just cost me £18,000. Its value will depreciate by 20% every year.
How much will it be worth when I trade it in 3 years from now? (3)

4. The pressure in my car tyre should be 30psi, but a nail in it is causing it to lose pressure at the rate of 15% every mile that I drive.
How far can I drive before the pressure falls below 20psi? (5)

5. Hassan has been told his hourly pay is to increase by 6% to £9.54.
Calculate his hourly rate before the increase. (3)

6. Due to fire damage, the value of a painting has fallen by 34% and is now valued at £4158.
What was its value before the damage? (3)

22 marks

National 5 Homework – Applications

WORKING with FRACTIONS

1. Work out the answers to the following:

(a) $\frac{2}{5} + \frac{1}{7}$ (b) $3\frac{3}{4} - \frac{7}{11}$ (c) $2\frac{1}{3} + 1\frac{2}{5}$ (d) $6\frac{3}{7} - 3\frac{5}{9}$
(e) $\frac{2}{3} \times \frac{3}{4}$ (f) $\frac{5}{9} \div \frac{15}{36}$ (g) $2\frac{4}{7} \times \frac{28}{45}$ (h) $5\frac{1}{2} \div 3\frac{2}{3}$ (8)

2. Siobhan likes to go to the gym. Last week she spent a total of $8\frac{1}{2}$ hours there.



If she went on 6 days, calculate the mean number of hours she spent in the gym each day. (2)

3. Calculate: (a) $\frac{7}{8} + \frac{4}{5} - \frac{3}{7}$ (b) $\frac{5}{8} - \frac{2}{9} \times \frac{3}{10}$ (c) $2\frac{1}{4} \div \left(\frac{9}{10} + \frac{2}{3}\right)$ (3)

4. Billy is a long distance lorry driver. One day he had to drive to Birmingham. He drove for $2\frac{1}{2}$ hours at an average speed of 76 km/h and then for $3\frac{2}{3}$ hours at an average speed of 81km/h before arriving at his destination.



- (a) How far did he drive during the first part of his journey?
(b) How far did he drive during the second part?
(c) How far did he travel altogether?
(d) How many hours did it take him in total?
(e) What was his average speed over the whole journey (6)

5. Laura has applied to join the RAF and has to sit an 'Entrance Test'. Part of it includes some problems with fractions. Work out the answers.

(a) $\frac{5}{6} + \frac{3}{7}$ (b) $3\frac{3}{8} - \frac{5}{16}$ (c) $\frac{11}{15} \times \frac{3}{22}$ (d) $\frac{34}{45} \div \frac{85}{102}$
(e) A plank of wood $3\frac{3}{4}$ metres long is cut up into 5 equal pieces. How long is each piece?
(f) Each cow in a herd of 25 produces $4\frac{2}{3}$ litres of milk. How much milk is this in total? (6)

25 marks

National 5 Homework – Applications

COMPARING DATA SETS using STATISTICS

1. Find the median, the upper and lower quartiles and the interquartile range for:

(a) 1 2 4 7 7 10 13 (4)

(b) 26 13 25 27 23 23 15 12 20 (5)

2. A set of test marks is shown below.

28 26 34 37 27 44
21 27 18 23 26 27 13

Use an appropriate formula to calculate the mean and standard deviation. (5)

3. (a) A quality control examiner on a production line measures the weight in grams of cakes coming off the line. In a sample of eight cakes the weights were

150 147 148 153 149 143 145 149

Calculate the mean and standard deviation. (5)

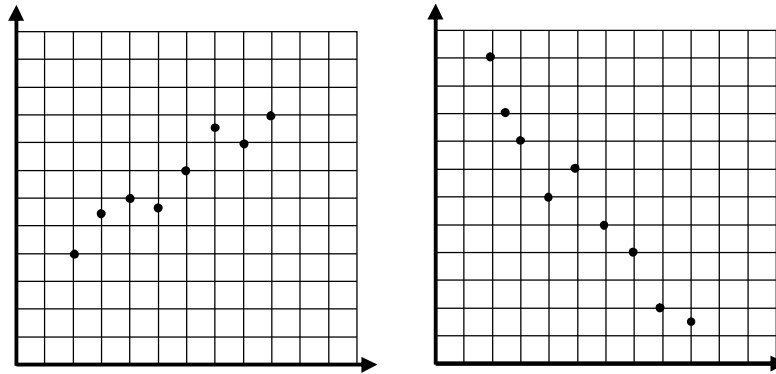
(b) On a second production line, a sample of 8 cakes gives a mean of 149 and a standard deviation of 6.1. Compare the distribution of the cakes produced on the two production lines. (1)

20 marks

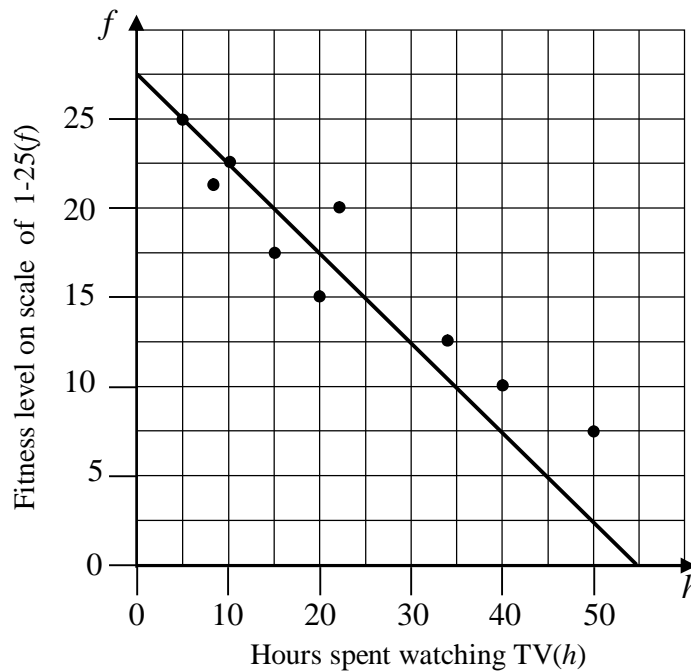
National 5 Homework – Applications

FORMING a LINEAR MODEL from a given SET of DATA

1. Copy these graphs and use your ruler to draw what you think is the line of best fit. (2)



2. A health visitor measured the fitness level of a group of teenagers and recorded B the number of hours they watched television in a week. She then drew this graph and the line of best fit. (3)



Find the equation of the line of best fit drawn.

3. The data below shows the marks gained by seven pupils in two class tests.

Maths	10	35	60	42	24	17	56
Physics	23	57	88	62	40	33	85

- (a) Show the data on a scattergraph and draw the line of best fit. (3)
- (b) Find the equation of your line of best fit. (3)
- (c) Use your equation to estimate the Physics mark of a pupil whose Maths mark was 50. (1)

ANSWERS

National 5 Homework – Applications

TRIGONOMETRY (1)

1. 27.3m^2
2. 15.6cm
3. 72.8cm
4. 105.6°

National 5 Homework – Applications

TRIGONOMETRY (2) – PROBLEMS

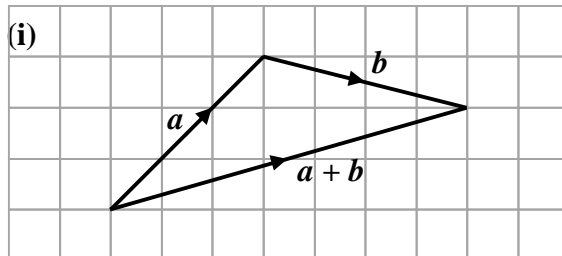
1. 084°
2. 3111metres
3. (a) 82° (b) 53.5 km^2

National 5 Homework – Applications

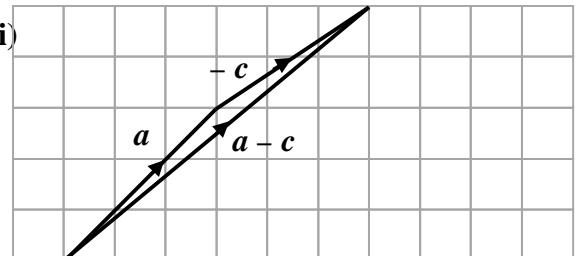
WORKING with VECTORS

1. (a) $a = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$ (b) $b = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$ (c) $c = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$

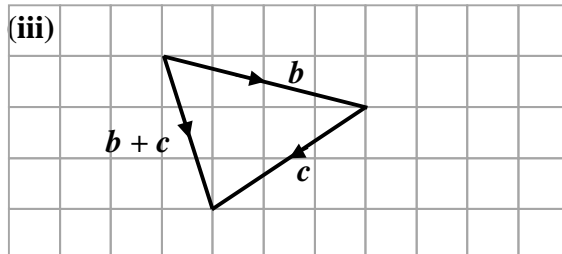
(b)



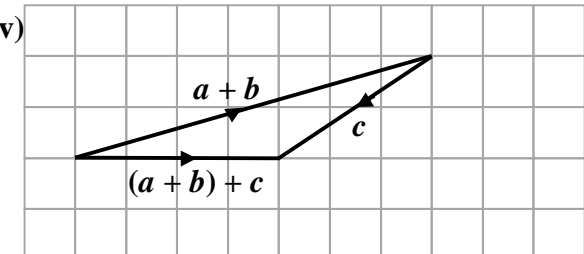
(ii)



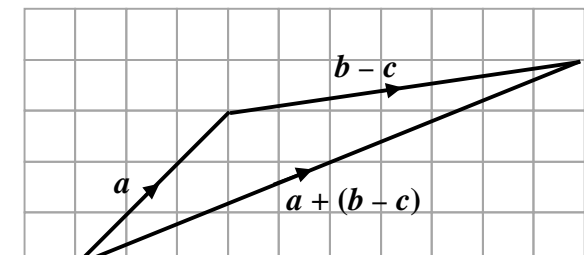
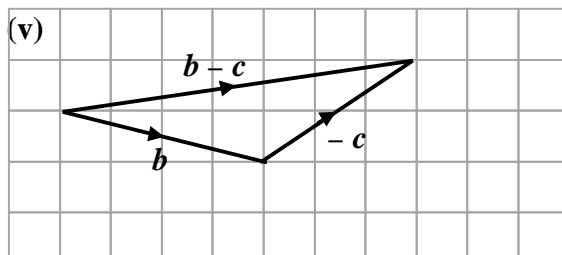
(iii)



(iv)



(v)



(c) (i) $\begin{pmatrix} 7 \\ 2 \end{pmatrix}$; $\sqrt{53} = 7.3$ (ii) $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$; $\sqrt{10} = 3.2$

2. (a) $b + a$ (b) $a - b$ (c) $\frac{1}{2}(a - b)$

3. Q(8, 0, 0); R(8, 10, 0); S(0, 10, 0); P(4, 5, 15)

4. $\begin{pmatrix} 4 \\ 4 \\ -1 \end{pmatrix}$; $\sqrt{33}$

National 5 Homework – Applications

WORKING with PERCENTAGES

1. £787.40
2. 3 years to reach at least £1400
3. £9216
4. 2 miles
5. £9
6. £6300

National 5 Homework – Applications

WORKING with FRACTIONS

1. (a) $\frac{19}{35}$ (b) $3\frac{5}{44}$ (c) $3\frac{11}{15}$ (d) $2\frac{55}{63}$
(e) $\frac{1}{2}$ (f) $1\frac{1}{3}$ (g) $1\frac{3}{5}$ (h) $1\frac{1}{2}$
2. $1\frac{5}{12}$ 3. (a) $1\frac{69}{280}$ (b) $\frac{67}{120}$ (c) $1\frac{41}{94}$
4. (a) 190 km (b) 297 km (c) 487 km (d) $6\frac{1}{6}$ (e) $78\frac{36}{37}$
5. (a) $1\frac{11}{42}$ (b) $3\frac{1}{16}$ (c) $\frac{1}{10}$ (d) $\frac{68}{75}$
(e) $\frac{3}{4}$ metre (f) $116\frac{2}{3}$ litres

National 5 Homework – Applications

COMPARING DATA SETS using STATISTICS

- (a) $Q_1 = 2; Q_2 = 7; Q_3 = 10; IQR = 8$

(b) $Q_1 = 14; Q_2 = 23; Q_3 = 25.5; IQR = 11.5$
- Mean = 27; SD = 8
- (a) Mean = 148; SD = 3.1

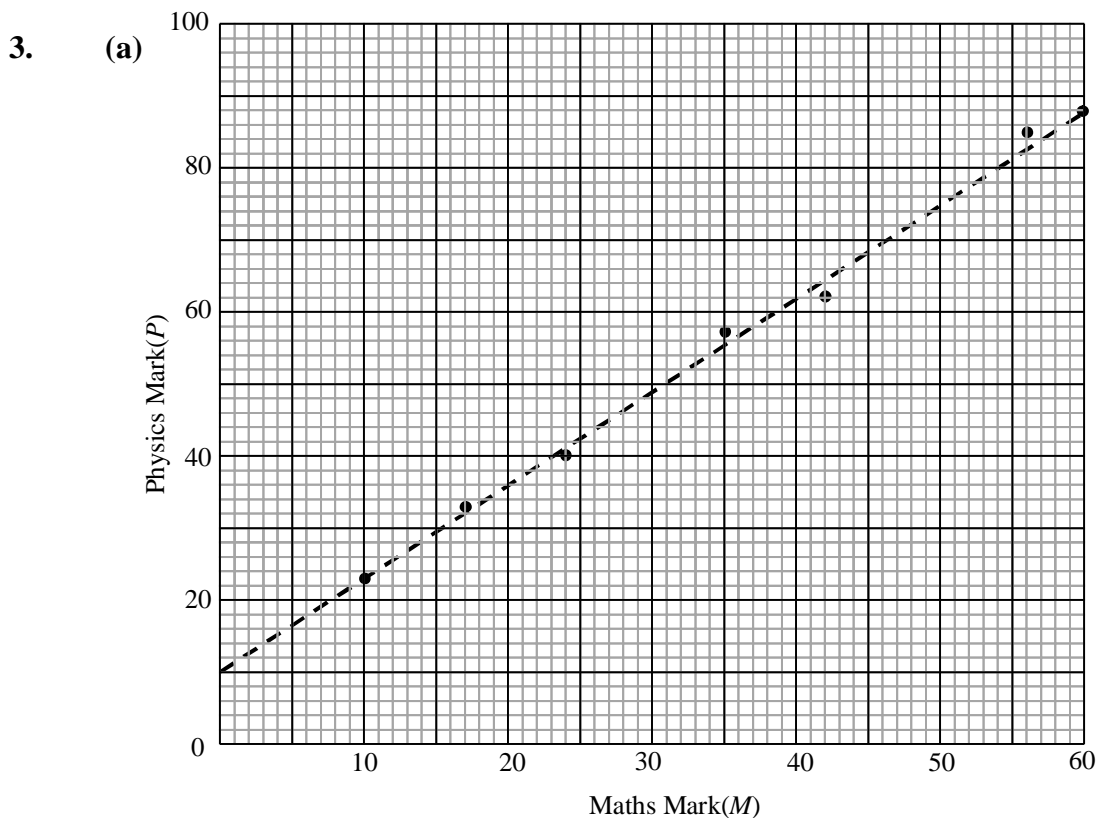
(b) On average the second line produces cakes where the weights are less consistent.

National 5 Homework – Applications

FORMING a LINEAR MODEL from a given SET of DATA

- (a) and (b) Any reasonable lines drawn

2. $f = -\frac{1}{2}h + 27.5$



(b) $P = \frac{4}{3}h + 10$ (c) approx 48

1. $A = \frac{1}{2} \times 7 \times 9 \times \sin 60^\circ$ *l*
 $= 27.3\text{m}^2$ *l* [2 marks]

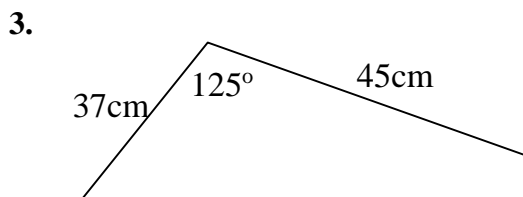
2. Shortest side opposite 35° . *l* $A = \frac{1}{2} \times 7 \times 9 \times \sin 60^\circ$
 Third angle is 82° . *l* $= 27.3\text{cm}^2$

Use Sine rule

$$\frac{x}{\sin 35^\circ} = \frac{27}{\sin 82^\circ}$$
 l

$$x = \frac{27 \sin 35^\circ}{\sin 82^\circ}$$

$$= \underline{15.6\text{cm}}$$
 l [4 marks]



Cosine rule for finding a side

$$x^2 = 37^2 + 45^2 - 2 \times 37 \times 45 \cos 125^\circ$$
 l
 $= 5304$ *l*

$$x = \sqrt{5304}$$
 l
 $= \underline{72.8\text{cm}}$ [4 marks]

4. Largest angle is opposite largest side. *l*

Use Cosine rule for finding an angle.

$$\cos \theta = \frac{11 \cdot 2^2 + 14 \cdot 3^2 - 20 \cdot 4^2}{2 \times 11 \cdot 2 \times 14 \cdot 3}$$
 l
l

$$= -0.26919955$$

 $\theta = \underline{105.6^\circ}$ *l* [4 marks]

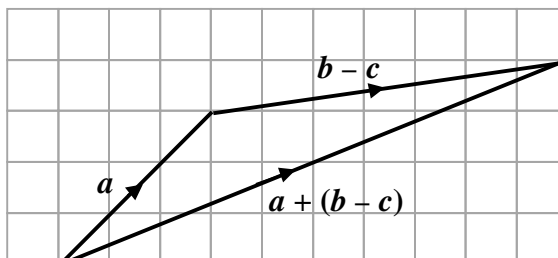
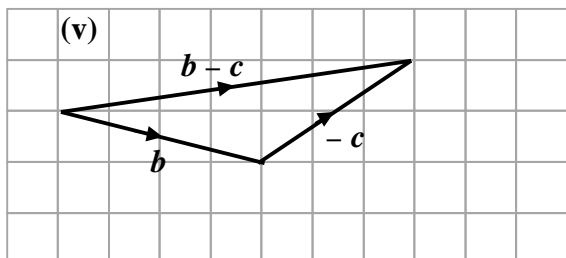
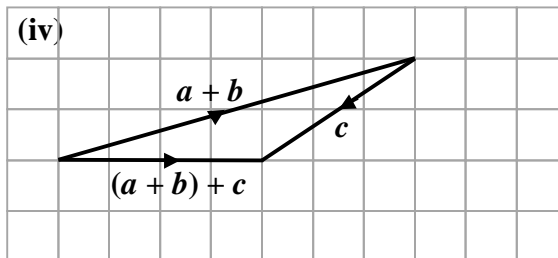
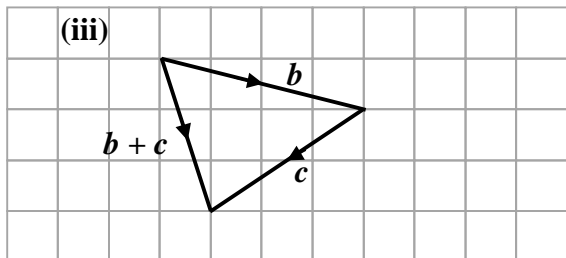
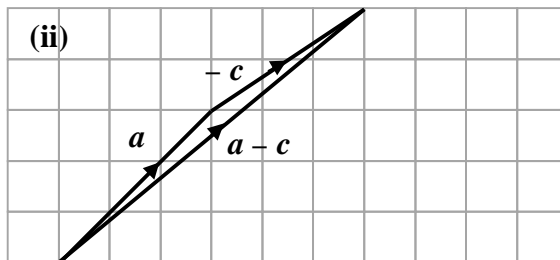
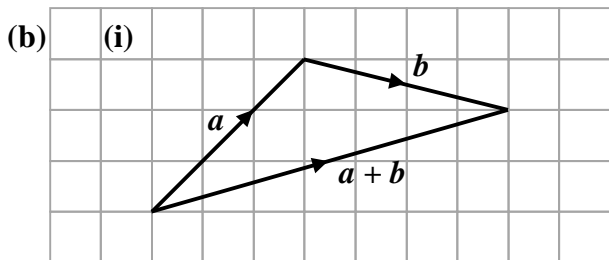
Total: 14 marks

National 5 Trigonometry (2)**Homework Marking Scheme – APPS**

1. Find angle A *l*
- Use cosine rule for angle *l*
- $$\cos A = \frac{90^2 + 75^2 - 60^2}{2 \times 90 \times 75} \quad l$$
- Evaluates $\cos A$ *l*
- $$A = 41.4^\circ \quad l$$
- Bearing = $125 - 41^\circ = 084^\circ$ *l* [6 marks]
2. Strategy: find AB *l*
- Use sine rule *l*
- $$\frac{AB}{\sin 7^\circ} = \frac{3000}{\sin 140^\circ} \quad l$$
- $AB = 569 \text{ m}$ *l*
- Strategy: find BC *l*
- Use cosine rule or Sine rule for side
- $$3000^2 + 569^2 - 2 \times 3000 \times 569 \cos 33^\circ$$
- Or *l*
- $$\frac{BC}{\sin 33^\circ} = \frac{3000}{\sin 140^\circ}$$
- 2542 m *l*
- $2542 + 569 = 3111 \text{ m}$ *l* [8 marks]
3. (a) length of third side is 14km *l*
- Use cosine rule for angle *l*
- $$\cos A = \frac{9^2 + 12^2 - 14^2}{2 \times 9 \times 12} \quad l$$
- $A = 82^\circ$ *l*
- (b) $A = \frac{1}{2} \times 9 \times 12 \times \sin 82^\circ$ *l*
- 53.5 km^3 *l* [6 marks]

Total: 20 marks

1. (a) $a = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$ (b) $b = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$ (c) $c = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$ 1 each [3 marks]



(i) – (iv) 2 marks each – 1 for individual vectors – 1 for resultant vectors

(v) 3 marks – 1 finding $b - c$ – 1 for second diagram – 1 for resultant vector [9 marks]

- (c) (i) $\begin{pmatrix} 7 \\ 2 \end{pmatrix}$; $\sqrt{53} = 7.3$ (ii) $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$; $\sqrt{10} = 3.2$

2 marks each – 1 for components – 1 for magnitude [4 marks]

2. (a) $\vec{PR} = \vec{PS} + \vec{SR} = b + a$ (b) $\vec{SQ} = \vec{SP} + \vec{PQ} = a - b$

(c) $\vec{SM} = \frac{1}{2} \vec{SQ} = \frac{1}{2} (a - b)$

2 marks each – 1 for path – 1 for vectors [6 marks]

3. Q(8, 0, 0); R(8, 10, 0); S(0, 10, 0); P(4, 5, 15) 1 each point [4 marks]

4. $\begin{pmatrix} 4 \\ 4 \\ -1 \end{pmatrix}$ 1 knowing to add + 1 answer

$\sqrt{33}$ 1 knowing how to find magnitude

1 answer [4 marks]

Total: 30 marks

National 5 Working with Percentages**Homework Marking Scheme – APPS**

1.	700×1.04^3	<i>1</i>	<i>correct multiplier</i>	
	£787.40	<i>1</i>	<i>correct power</i>	
		<i>1</i>		[3 marks]
2.	strategy	<i>1</i>		
	$1200 \times 1.055 = £1266$	<i>1</i>		
	$1266 \times 1.055 = £1335.63$	<i>1</i>		
	$£1335.63 \times 1.055 = £1409.08$	<i>1</i>		
	3 years to reach at least £1400	<i>1</i>		[5 marks]
3.	18000×0.80^3	<i>1</i>	<i>correct multiplier</i>	
	£9216	<i>1</i>	<i>correct power</i>	
		<i>1</i>		[3 marks]
4.	strategy	<i>1</i>		
	$30 \times 0.85 = 25.5$	<i>1</i>		
	$25.5 \times 0.85 = 21.675$	<i>1</i>		
	$21.675 \times 0.85 = 18.42375$	<i>1</i>		
	2 miles	<i>1</i>		[5 marks]
5.	$1 + 0.06 = 1.06$	<i>1</i>		
	$9.54 \div 1.06$	<i>1</i>		
	£9	<i>1</i>		[3 marks]
6.	$1 - 0.34 = 0.66$	<i>1</i>		
	$9.54 \div 0.66$	<i>1</i>		
	£6300	<i>1</i>		[3 marks]

Total: 22 marks**National 5 Working with Fractions****Homework Marking Scheme – APPS**

1. (a) $\frac{19}{35}$ (b) $3\frac{5}{44}$ (c) $3\frac{11}{15}$ (d) $2\frac{55}{63}$
 (e) $\frac{1}{2}$ (f) $1\frac{1}{3}$ (g) $1\frac{3}{5}$ (h) $1\frac{1}{2}$ [8 marks]

2. $8\frac{1}{2} \div 6$ / *dividing*
 $1\frac{5}{12}$ / [2 marks]

3. (a) $1\frac{69}{280}$ (b) $\frac{67}{120}$ (c) $1\frac{41}{94}$ [3 marks]

4. (a) 190 km /
 (b) 297 km /
 (c) 487 km /
 (d) $6\frac{1}{6}$ /
 (e) $487 \div 6\frac{1}{6}$ /

- $78\frac{36}{37}$ km/h / [6 marks]

5. (a) $1\frac{11}{42}$ (b) $3\frac{1}{16}$ (c) $\frac{1}{10}$ (d) $\frac{68}{75}$
 (e) $\frac{3}{4}$ metre (f) $116\frac{2}{3}$ litres [6 marks]

Total: 25 marks

1. (a) $Q_1 = 2; Q_2 = 7; Q_3 = 10; IQR = 8$ *1 each* [4 marks]
- (b) 12 13 15 20 23 23 25 26 27 *1 ordering*
- $Q_1 = 14; Q_2 = 23; Q_3 = 25.5; IQR = 11.5$ *1 each* [5 marks]
2. $351 \div 13$ *1*
- 27 *1*
- $36 + 1 + 0 + 1 + 81 + 49 + 16 + 100 + 1 + 0 + 0 + 289 + 196$ *1*
- $SD = \sqrt{\frac{770}{12}}$ *1*
- $SD = 8$ *1* [5 marks]
3. (a) $1184 \div 8$ *1*
- 148 *1*
- $4 + 1 + 0 + 25 + 1 + 25 + 9 + 1$ *1*
- $SD = \sqrt{\frac{66}{7}}$ *1*
- $SD = 3.1$ *1* [5 marks]
- (b) Weights on the second production line are
less consistent *1* [1 mark]

Total: 20 marks

1. (a) and (b) Any reasonable lines drawn [2 marks]

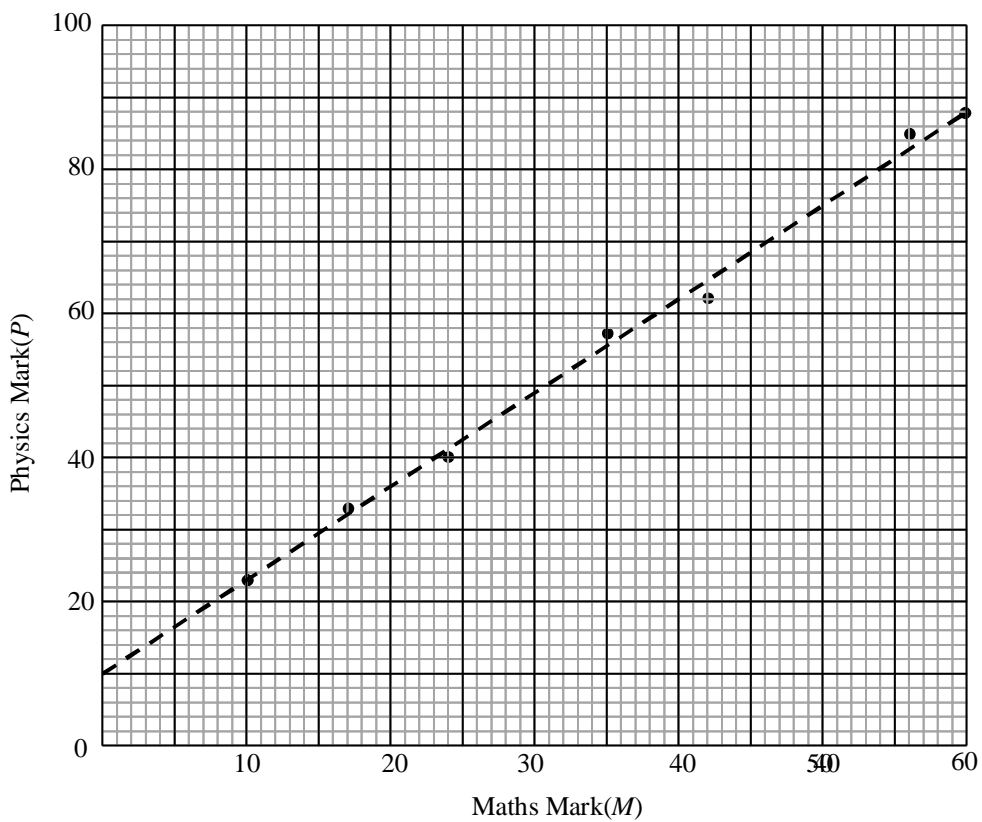
2. $m = -\frac{1}{2}$ 1

27.5 1

$f = -\frac{1}{2}h + 27.5$ 1 [3 marks]

3. (a) points plotted 2

line drawn 1 [3 marks]



(b) $m = \frac{4}{3}$ 1

10 1

$P = \frac{4}{3}h + 10$ 1 [3 marks]

(c) approx 77 1 [1 mark]

Total: 12 marks