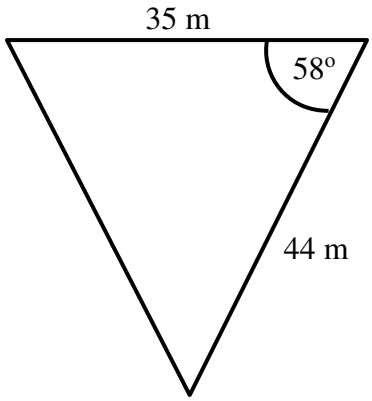
Practice Unit Assessment (1) for National 5 Applications

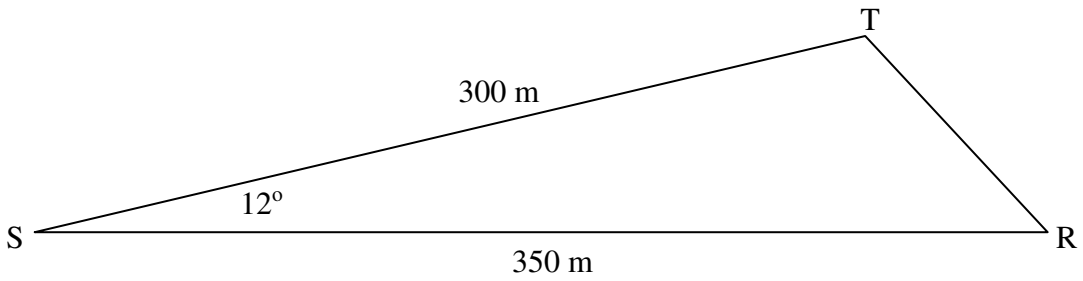
1. A farmer wishes to spread fertiliser on a triangular plot of ground.

The diagram gives the dimensions of the plot.



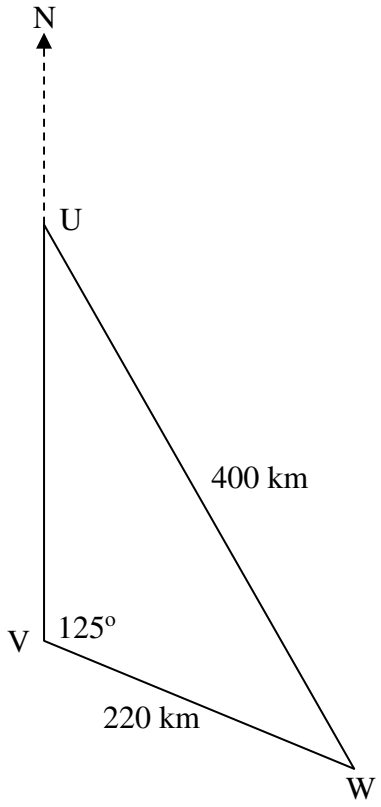
Calculate the area of this plot to the nearest square metre.

2. The diagram shows the paths taken by two runners, Barry and Charlie. Barry runs 350 metres from point S to position R. Charlie runs 300 metres to position T.



` What is the shortest distance between the two runners? [i.e. the distance TR on the diagram]

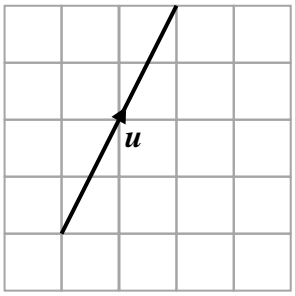
3. On an orienteering course there are three checkpoints at points U, V and W as shown in the diagram below.

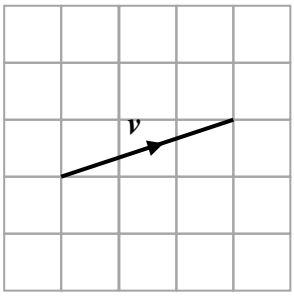


W is 220 kilometres from V and 400 kilometres from U.
W is on a bearing of 125° from V.

Calculate the bearing of W from U. i.e. the size of angle NUW in the diagram.
Give your answer to the nearest degree.

4. The diagrams below show 2 directed line segments $\boldsymbol{u}$ and $\boldsymbol{v}$.

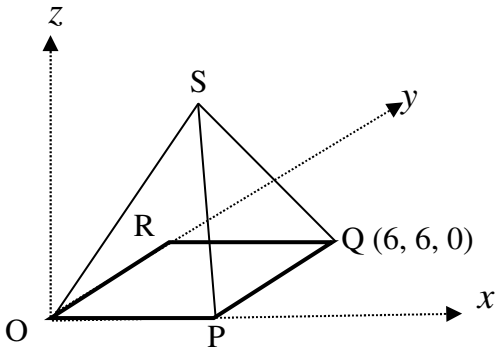




Draw the resultant of $3\boldsymbol{u}+\boldsymbol{v}$.

5. The diagram below shows a square based model of a glass pyramid of height 8 cm. Square OPQR has a side length of 6 cm.

The coordinates of Q are (6, 6, 0). R lies on the y-axis.



Write down the coordinates of S.

6. The forces acting on a body are represented by three vectors $\boldsymbol{a}$, $\boldsymbol{b}$ and $\boldsymbol{c}$ as given below.

$$\boldsymbol{a} = \begin{pmatrix} 5 \\ 2 \\ 2\cdot 5 \end{pmatrix} \qquad \boldsymbol{b} = \begin{pmatrix} -3 \\ 7 \\ 5\cdot 5 \end{pmatrix} \qquad \boldsymbol{c} = \begin{pmatrix} 1\cdot 5 \\ 6 \\ -2 \end{pmatrix}$$

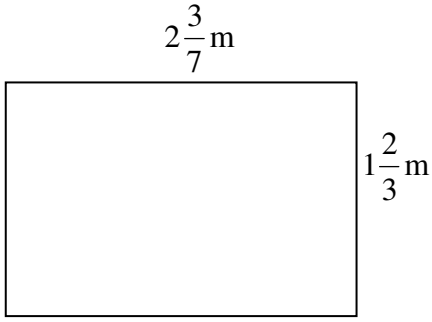
Find the resultant force.

7. Vector $\boldsymbol{p} = \begin{pmatrix} 5 \\ 3 \end{pmatrix}$ and vector $\boldsymbol{q} = \begin{pmatrix} 1 \\ -3 \end{pmatrix}$.

Calculate $\left| 2\boldsymbol{p} + \boldsymbol{q} \right|$

8. Kashef bought a new car for £24 000. Its value decreased by 12% each year. Find the value of the car after 5 years.

9. A desk top has measurements as shown in the diagram.



Calculate the exact area of the desk top (in m^2).

10. A man invested some money in a Building Society last year.

It has increased in value by 15% and is now worth £2760.

Calculate how much the man invested.

11. The cost of a set menu meal in 7 different café style restaurants were as follows:

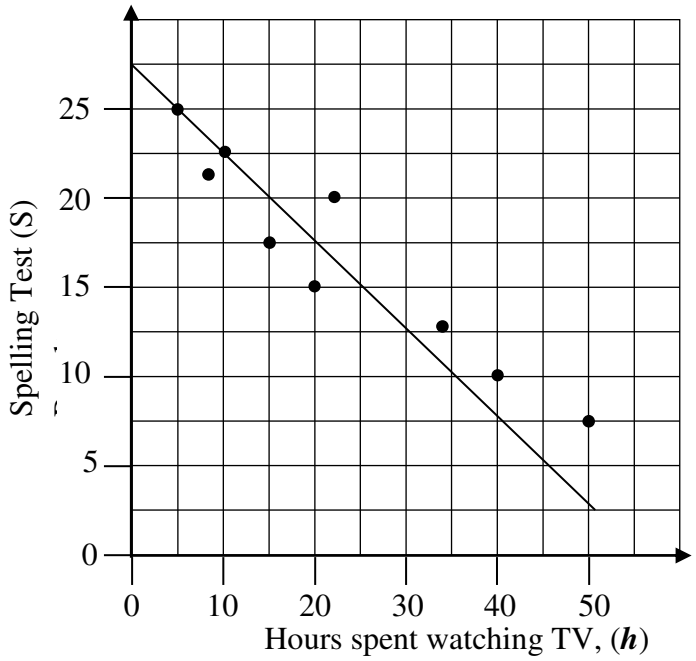
£14 £17 £13 £14 £11 £19 £17

(a) Calculate the mean and standard deviation of these costs.

(b) In 7 up market restaurants the mean cost of a meal was £22 with a standard deviation of 2·2.

Using these statistics, compare the profits of the two companies and make two valid comparisons.

12. A primary teacher took a note of the results in a spelling test and the number of hours of TV that some of her pupils watched in a week. She then drew the following graph.



(a) Determine the gradient and the y-intercept of the line of best fit shown.

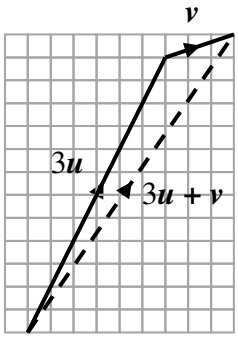
(b) Using these values for the gradient and the y-intercept, write down the equation of the line.

(c) Estimate the mark in the spelling test if the pupil spent 25 hours watching television.

End of Question Paper

Practice Unit Assessment (1) for Applications: Marking Scheme

Points of reasoning are marked # in the table.

Question	Main points of expected responses	
1	•[1] substitute into formula •[2] correct answer	•[1] $\frac{1}{2}\times 35\times 44\times \sin 58°$ •[2] 653 m^2
2	•[1] use correct formula •[2] substitute correctly •[3] process to s^2 •[4] take square root	•[1] selects cosine rule •[2] $s^2 = 300^2 + 350^2 - 2\times 300\times 350\times \cos 12°$ •[3] 7 089 •[4] 84·1 metres (rounding not required)
3	#2.1 uses correct strategy •[1] finds angle U •[2] states bearing from U	#2.1 $\sin U = \frac{220\sin 125°}{400}$ then valid steps below •[1] 26·8° •[2] 153·2° (rounding not required)
4	•[1] draws 3***u*** •[2] applies head-to-tail method when adding ***v*** •[3] draws resultant from tail of 3***u*** to head of ***v***.	
5	•[1] correct point	•[1] (3, 3, 8)

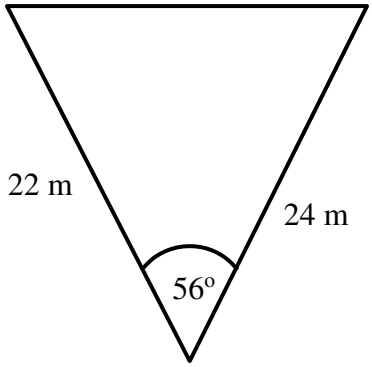
6	$\bullet^1$ add to get resultant $\bullet^2$ correct answer	$\bullet^1$ $\begin{pmatrix}5\\2\\2\cdot5\end{pmatrix}+\begin{pmatrix}-3\\7\\5\cdot5\end{pmatrix}+\begin{pmatrix}1\cdot5\\6\\-2\end{pmatrix}$ $\bullet^2$ $\begin{pmatrix}3\cdot5\\15\\6\end{pmatrix}$
7	$\bullet^1$ correct scalar multiplication then addition $\bullet^2$ calculate magnitude $\bullet^3$ correct answer	$\bullet^1$ $\begin{pmatrix}10\\6\end{pmatrix}+\begin{pmatrix}1\\-3\end{pmatrix}=\begin{pmatrix}11\\3\end{pmatrix}$ $\bullet^2$ $\sqrt{11^2+3^2}$ $\bullet^3$ $\sqrt{130}$
8	$\bullet^1$ start calculation $\bullet^2$ process calculation $\bullet^3$ correct answer Note: repeated subtraction method can be used	$\bullet^1$ 0·88 $\bullet^2$ $24\,000 \times 0{\cdot}88^5$ $\bullet^3$ £12 665·57 equivalent
9	$\bullet^1$ area calculation $\bullet^2$ correct answer	$\bullet^1$ $\frac{17}{7}\times\frac{5}{3}$ $\bullet^2$ $\frac{85}{21}=4\frac{1}{21}$ m²
10	#2.1 appropriate strategy $\bullet^1$ correct answer	#2.1 eg 1 + 0·15 x = £2760 $\bullet^1$ £2 400
11 (a) **(b)**	$\bullet^1$ mean for A $\bullet^2$ calculates $(x-\bar{x})^2$ $\bullet^3$ substitute into formula $\bullet^4$ correct standard deviation #2.2 Compares mean and standard deviation in a valid way for data	$\bullet^1$ 105 ÷ 7 = 15 $\bullet^2$ 1, 4, 4, 1, 16, 16, 4 $\bullet^3$ $\sqrt{\frac{46}{6}}$ $\bullet^4$ 2·77 (rounding not required) (Equivalent calculations can be used) #2.2 On average up market prices more expensive There is less of a spread in up market restaurants

12 (a)	$\bullet^1$ chooses 2 distinct points and substitutes into gradient formula $\bullet^2$ calculates gradient $\bullet^3$ finds intercept	$\bullet^1$ $m = \dfrac{22 \cdot 5 - 7 \cdot 5}{10 - 40}$ $\bullet^2$ $m = -\dfrac{1}{2}$ (or based on gradient line of best fit $\bullet^3$ $c = 27 \cdot 5$ (approximately or by calculation or from graph)
(b) **(c)**	$\bullet^4$ writes down equation # 2.2 estimate mark	$\bullet^4$ $S = -\dfrac{1}{2}h + 27 \cdot 5$ (or equivalent) #2.2 Approximately 15 hours

Practice Unit Assessment (2) for National 5 Applications

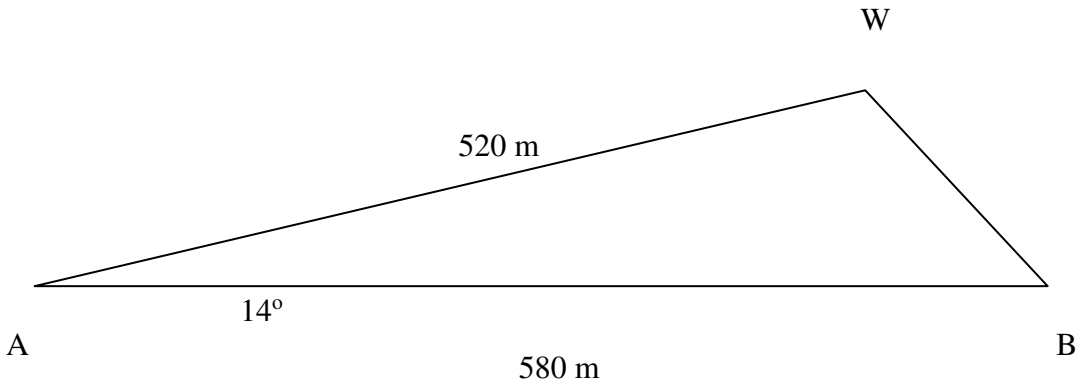
1. A children's play park, which is triangular in shape, has to be covered with a protective matting.

The diagram gives the dimensions of the plot.



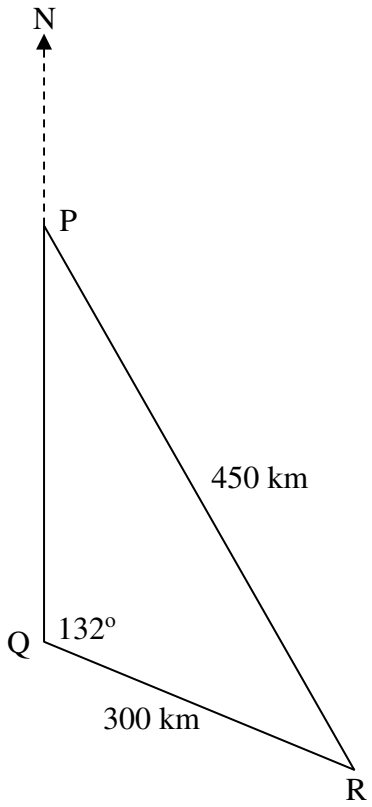
Calculate the area, to the nearest square metre, of protective matting needed.

2. The diagram shows the courses followed by two ships, the Westminster and the Bogota, after they leave Port A. The Westminster sails 520 metres to position W and the Bogota 580 metres to position B.



` How far apart are the ships?[i.e. the distance WB on the diagram]

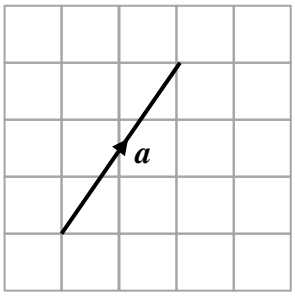
3. On a radar screen, three planes, P, Q and R are at the positions shown in the diagram.

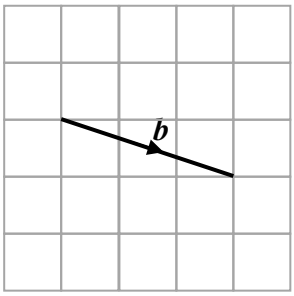


R is 300 kilometres from Q and 450 kilometres from P.
R is on a bearing of 132° from Q.

Calculate the bearing of R from P. i.e. the size of angle NPR in the diagram.
Give your answer to the nearest degree.

4. The diagrams below show 2 directed line segments $\boldsymbol{a}$ and $\boldsymbol{b}$.

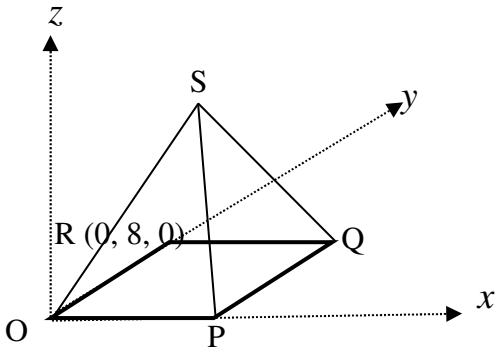




Draw the resultant of $2\boldsymbol{a} + 2\boldsymbol{b}$.

5. The diagram below shows a square based model of a glass pyramid of height 10 cm. Square OPQR has a side length of 8 cm.

The coordinates of R are (0, 8, 0). P lies on the x-axis.



Write down the coordinates of S.

6. The forces acting on a body are represented by three vectors $\boldsymbol{k}$, $\boldsymbol{l}$ and $\boldsymbol{m}$ as given below.

$$\boldsymbol{k} = \begin{pmatrix} 3 \\ 2 \cdot 5 \\ -4 \end{pmatrix} \qquad \boldsymbol{l} = \begin{pmatrix} 2 \\ 4 \\ 1 \cdot 5 \end{pmatrix} \qquad \boldsymbol{m} = \begin{pmatrix} -3 \cdot 5 \\ 0 \\ -4 \end{pmatrix}$$

Find the resultant force.

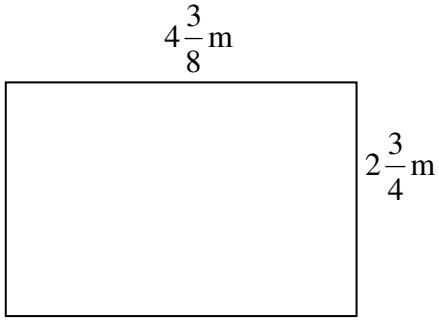
7. Vector $\boldsymbol{a} = \begin{pmatrix} 3 \\ 6 \end{pmatrix}$ and vector $\boldsymbol{b} = \begin{pmatrix} -2 \\ -5 \end{pmatrix}$.

Calculate $\left| \boldsymbol{a} + 2\boldsymbol{b} \right|$

8. Due to inflation, house prices are expected to rise by 3·6% each year.

What will the average house price be in 3 years if it is £142,000 today?

9. A room has dimensions as shown in the diagram.



Calculate the exact amount of carpet that would have to be bought for the room.

10. A woman bought an antique painting last year.

It has increased in value by 35% and is now worth £3 510.

Calculate how much the woman paid for the painting.

11. 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

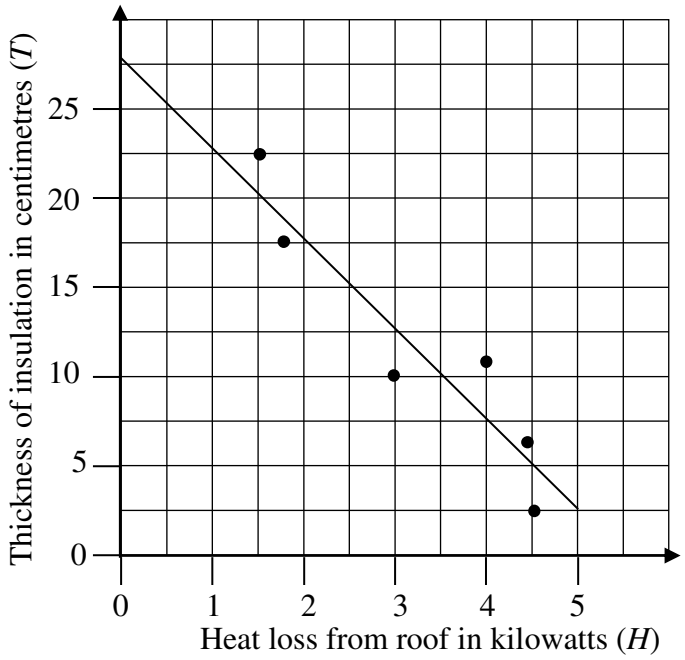
150 147 148 153 149 143 145 149

(a) Find the mean and standard deviation of the above weights.

(b) On a second production line, a sample of 8 cakes gives a mean of 148 and a standard deviation of 6·1.

Using these statistics, compare the profits of the two companies and make two valid comparisons.

12. The diagram below shows the connection between the thickness of insulation in a roof and the heat lost through the roof. The line of best fit has been drawn.



(a) Determine the gradient and the y-intercept of the line of best fit shown.

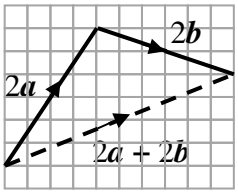
(b) Using these values for the gradient and the y-intercept, write down the equation of the line.

(c) Estimate the thickness of insulation for a heat loss of 2·5 kilowatts.

End of Question Paper

Practice Unit Assessment (2) for Applications: Marking Scheme

Points of reasoning are marked # in the table.

Question	Main points of expected responses	
1	•[1] substitute into formula	•[1] $\frac{1}{2}\times 22\times 24\times \sin 56°$
	•[2] correct answer	•[2] 219 m^2
2	•[1] use correct formula	•[1] selects cosine rule
	•[2] substitute correctly	•[2] $a^2 = 520^2 + 580^2 - 2\times 520\times 580\times \cos 14°$
	•[3] process to a^2	•[3] 21517
	•[4] take square root	•[4] 146·7 metres (rounding not required)
3	#2.1 uses correct strategy	#2.1 $\sin P = \frac{300\sin 132°}{450}$ then valid steps below
	•[1] finds angle P	•[1] 29·7°
	•[2] states bearing from P	•[2] 150·3° (rounding not required)
4	•[1] draws 2***a***	
	•[2] applies head-to-tail method when adding 2***b***	
	•[3] draws resultant from tail of 2***a*** to head of 2***b***	
5	•[1] correct point	•[1] (4, 4, 10)

6	•[1] add to get resultant •[2] correct answer	•[1] $\begin{pmatrix}3\\2\cdot5\\-4\end{pmatrix}+\begin{pmatrix}2\\4\\1\cdot5\end{pmatrix}+\begin{pmatrix}-3\cdot5\\0\\-4\end{pmatrix}$ •[2] $\begin{pmatrix}1\cdot5\\6\cdot5\\-6\cdot5\end{pmatrix}$
7	•[1] correct scalar multiplication then addition •[2] calculate magnitude •[3] correct answer	•[1] $\begin{pmatrix}3\\6\end{pmatrix}+\begin{pmatrix}-4\\-10\end{pmatrix}=\begin{pmatrix}-1\\-4\end{pmatrix}$ •[2] $\sqrt{(-1)^2+(-4)^2}$ •[3] $\sqrt{17}$
8	•[1] start calculation •[2] process calculation •[3] correct answer Note: repeated addition method can be used	•[1] 1·036 •[2] 142 000 × 1·036³ •[3] £157 894 equivalent
9	•[1] area calculation •[2] correct answer	•[1] $\frac{35}{8}\times\frac{11}{4}$ •[2] $\frac{385}{32}=12\frac{1}{32}$ m²
10	#2.1 appropriate strategy •[1] correct answer	#2.1 eg 1 + 0·35 x = £3510 •[1] £2 600
11 (a) **(b)**	•[1] mean for A •[2] calculates $(x-\bar{x})^2$ •[3] substitute into formula •[4] correct standard Deviation #2.2 Compares mean and standard deviation in a valid way for data	•[1] 1184 ÷ 8 = 148 •[2] 4, 1, 0, 25, 1, 25, 9, 1 •[3] $\sqrt{\frac{66}{7}}$ •[4] 3·07 (rounding not required) (Equivalent calculations can be used) #2.2 On average weights the same Wider spread on second line.

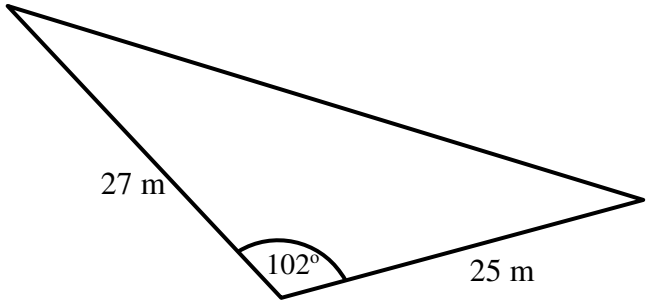
12 (a)	•[1] chooses 2 distinct points and substitutes into gradient formula •[2] calculates gradient •[3] finds intercept	•[1] $m = \frac{20-10}{1\cdot5-3\cdot5}$ •[2] $m = -5$ (or based on gradient line of best fit •[3] $c = 27\cdot5$ (approximately or by calculation or from graph)
(b)	•[4] writes down equation	•[4] $T = -5H + 27\cdot5$ (or equivalent)
(c)	# 2.2 estimate mark	#2.2 Approximately 15 cm

Practice Unit Assessment (3) for National 5 Applications

1. Turf has to be laid on a triangular plot of garden

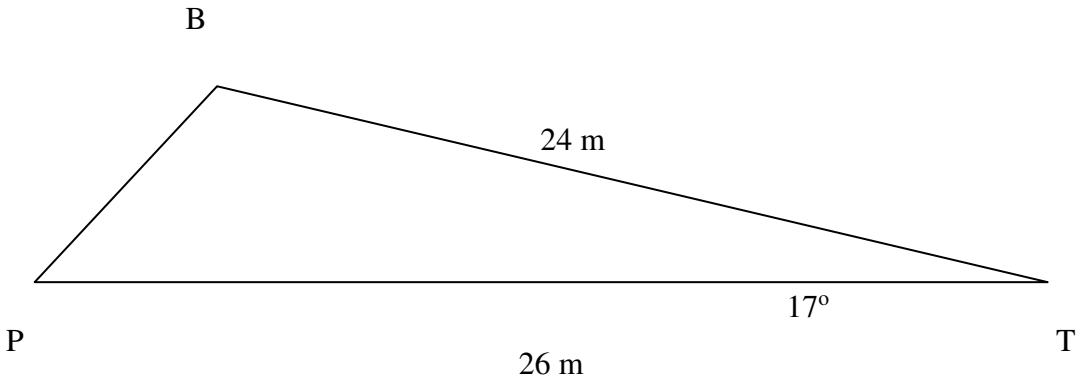
.

The diagram gives the dimensions of the plot.



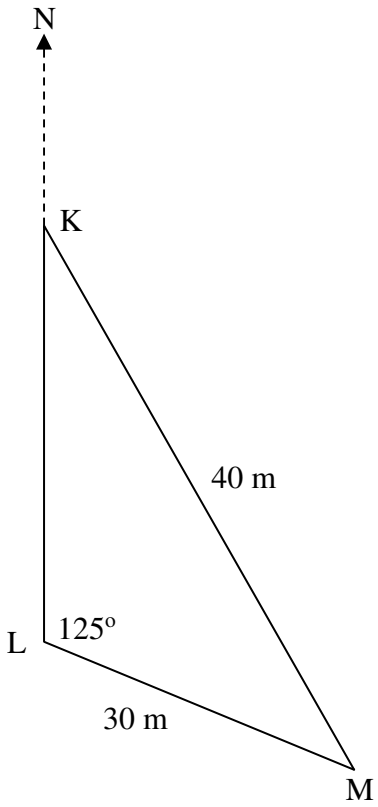
Calculate the area, to the nearest square metre, of turf that is required.

2. Billy and Peter are bowlers. They are playing a game and after they each throw their first bowl they are in the positions shown in the diagram.



` How far apart are the bowls after this first throw?[i.e. the distance PB on the diagram]

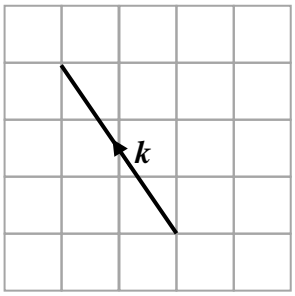
3. The positions of three players, K, L and M are shown in this diagram.

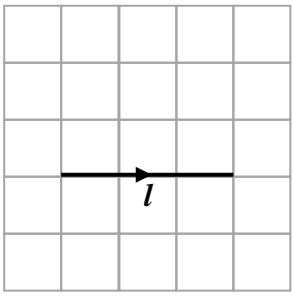


Player M is 30 metres from player L and 40 metres from player K.
M is on a bearing of 125° from L.

Calculate the bearing of player M from player K. i.e. the size of angle NKM in the diagram.
Give your answer to the nearest degree.

4. The diagrams below show 2 directed line segments $\boldsymbol{k}$ and $\boldsymbol{l}$.

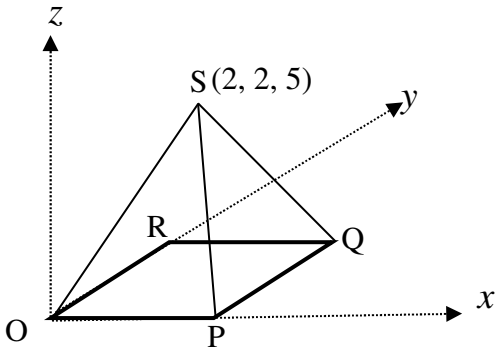




Draw the resultant of $\boldsymbol{k} + 2\boldsymbol{l}$.

5. The diagram below shows a square based model of a glass pyramid of height 5 cm. The base OPQR is a square.

The coordinates of S are (2, 2, 5). P lies on the x-axis and R lies on the y – axis.



Write down the coordinates of Q.

6. The forces acting on a body are represented by three vectors $\boldsymbol{x}$, $\boldsymbol{y}$ and $\boldsymbol{z}$ as given below.

$$\boldsymbol{x} = \begin{pmatrix} 4 \\ 2 \cdot 3 \\ -1 \end{pmatrix} \qquad \boldsymbol{y} = \begin{pmatrix} -2 \\ 2 \cdot 7 \\ 0 \cdot 5 \end{pmatrix} \qquad \boldsymbol{z} = \begin{pmatrix} -2 \\ 1 \\ -2 \end{pmatrix}$$

Find the resultant force.

7. Vector $\boldsymbol{x} = \begin{pmatrix} 3 \\ 6 \end{pmatrix}$ and vector $\boldsymbol{y} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$.

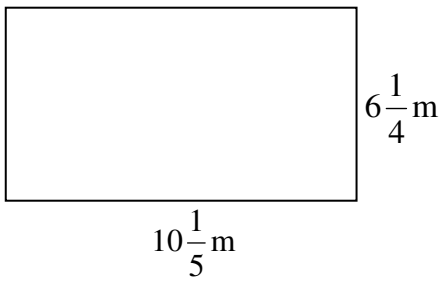
Calculate $\left| 3\boldsymbol{x} - 2\boldsymbol{y} \right|$

8. Chocolate fountains have become very popular at parties.

At one party 23% of the remaining chocolate was used every 20 minutes.

If 2kg of melted chocolate was added to the fountain at the start of the night, how much would be left after 1 hour?

9. Calculate the area of this piece of ground which has dimensions as shown in the diagram.



10. I bought a car three years ago.

Since then it has decreased in value by 45% and is now worth £6875.

How much did I pay for the car?

11. A set of Maths test marks for a group of students are shown below.

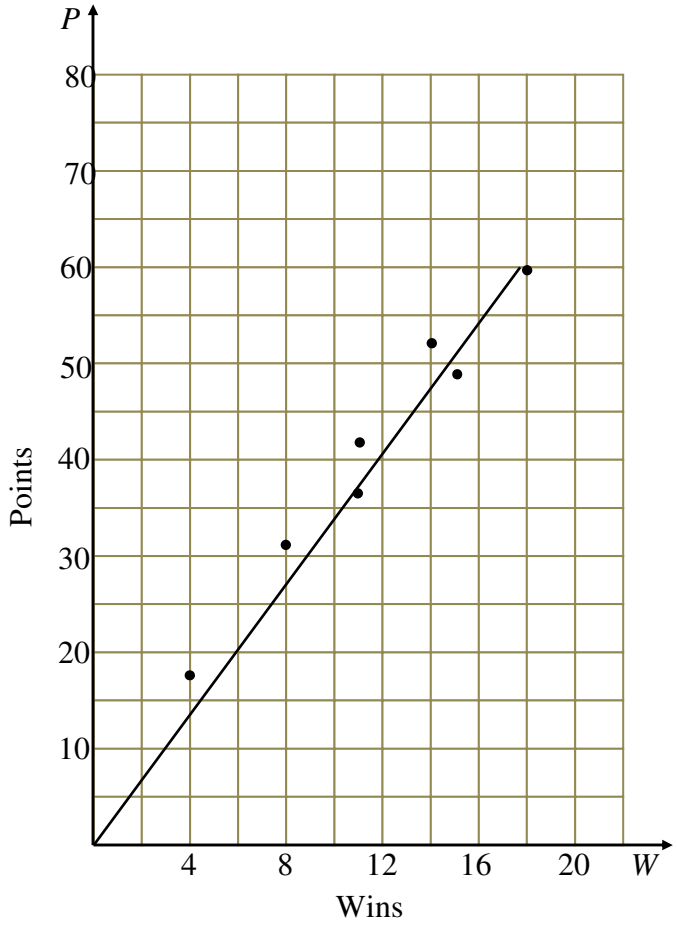
35 27 43 18 36 39

(a) Find the mean and standard deviation.

(b) Another group had a mean of 37 and a standard deviation of 8·6.

Compare the test marks of the two classes.

12. A selection of the number of games won and the total points gained by teams in the Scottish Premier League were plotted on this scattergraph and the line of best fit was drawn.



(a) Determine the gradient and the y-intercept of the line of best fit shown.

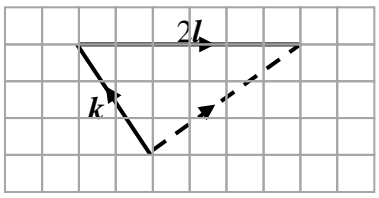
(b) Using these values for the gradient and the y-intercept, write down the equation of the line.

(c) Use your equation to estimate the number of points gained by a team who win 27 games.

End of Question Paper

Practice Unit Assessment (3) for Applications: Marking Scheme

Points of reasoning are marked # in the table.

Question	Main points of expected responses	
1	•[1] substitute into formula •[2] correct answer	•[1] $\frac{1}{2}\times 27\times 25\times \sin 102°$ •[2] 330 m^2
2	•[1] use correct formula •[2] substitute correctly •[3] process to t^2 •[4] take square root	•[1] selects cosine rule •[2] $t^2 = 24^2 + 26^2 - 2\times 24\times 26\times \cos 17°$ •[3] 58·53 •[4] 7·7 metres (rounding not required)
3	#2.1 uses correct strategy •[1] finds angle K •[2] states bearing from K	#2.1 $\sin K = \frac{30\sin 125°}{40}$ then valid steps below •[1] 38° •[2] 142° (rounding not required)
4	•[1] draws $\boldsymbol{k}$ •[2] applies head-to-tail method when adding $2\boldsymbol{l}$ •[3] draws resultant from tail of $\boldsymbol{k}$ to head of $2\boldsymbol{l}$	
5	•[1] correct point	•[1] (4, 4, 0)

6	•[1] add to get resultant •[2] correct answer	•[1] $\begin{pmatrix}4\\2\cdot3\\-1\end{pmatrix}+\begin{pmatrix}-2\\2\cdot7\\0\cdot5\end{pmatrix}+\begin{pmatrix}-\\1\\-2\end{pmatrix}$ •[2] $\begin{pmatrix}0\\6\\-2\cdot5\end{pmatrix}$
7	•[1] correct scalar multiplication then addition •[2] calculate magnitude •[3] correct answer	•[1] $\begin{pmatrix}9\\18\end{pmatrix}-\begin{pmatrix}4\\10\end{pmatrix}=\begin{pmatrix}5\\8\end{pmatrix}$ •[2] $\sqrt{5^2+8^2}$ •[3] $\sqrt{89}$
8	•[1] start calculation •[2] process calculation •[3] correct answer Note: repeated addition method can be used	•[1] 0·77 •[2] $2\,000\times0{\cdot}77^3$ •[3] 913g equivalent – 3
9	•[1] area calculation •[2] correct answer	•[1] $\frac{25}{4}\times\frac{51}{5}$ •[2] $\frac{255}{4}=63\frac{3}{4}$ m²
10	#2.1 appropriate strategy •[1] correct answer	#2.1 eg $(1-0{\cdot}45)\,x=$ £6 875 •[1] £12 500
11 (a) **(b)**	•[1] mean •[2] calculates $(x-\bar{x})^2$ •[3] substitute into formula •[4] correct standard deviation #2.2 Compares mean and standard deviation in a valid way for data	•[1] 198 ÷ 6 = 33 •[2] 4, 36, 100, 225, 9, 36 •[3] $\sqrt{\frac{410}{5}}$ •[4] 9 (rounding not required) (Equivalent calculations can be used) #2.2 On average second group had higher marks Second group's marks less spread out

12 (a)	$\bullet^1$ chooses 2 distinct points and substitutes into gradient formula $\bullet^2$ calculates gradient $\bullet^3$ finds intercept	$\bullet^1$ $m = \frac{40-20}{12-6}$ $\bullet^2$ $m = \frac{10}{3}$ (or based on gradient line of best fit) $\bullet^3$ $c = 0$ (approximately or by calculation or from graph)
(b)	$\bullet^4$ writes down equation	$\bullet^4$ $P = \frac{10}{3}W$ (or equivalent)
(c)	# 2.2 estimate mark	#2.2 90 points