

S3

Block Test 2



Revision Booklet

Factorising

1. Factorise the following:

a) $2x^2 + 8$

b) $5y^2 + 5$

c) $2x^2 - 3x$

d) $p^2 - p$

e) $2x^2 - 2x$

f) $3y^2 + 9y$

2. Factorise fully:

(Hint: think difference of two squares)

a) $n^2 - 4$

b) $16x^2 - 25$

c) $y^2 - z^2$

d) $2x^2 - 242$

e) $3p^2 - 3$

f) $12x^2 - 27$

3. Factorise fully:

a) $x^2 + 3x + 2$

b) $x^2 + 7x + 10$

c) $a^2 - 2a + 1$

d) $y^2 - 8y + 16$

e) $x^2 - x - 6$

f) $a^2 - 2a - 8$

g) $4y^2 + 14y - 8$

h) $8x^2 + 8x + 2$

i) $2a^2 - 7a + 3$

Multiplying out Brackets

1. Multiply out the brackets and simplify the following:

a) $(x + 6)(x + 3)$

b) $(y - 2)(y + 5)$

c) $(a + 8)(a - 2)$

d) $(t - 6)(t + 2)$

e) $(m + 5)(m - 4)$

f) $(n + 3)^2$

2. Remove the brackets and simplify the following:

a) $(3x + 6)(2x + 7)$

b) $(2y - 3)(y + 1)$

c) $(2t - 1)^2$

3. Simplify:

a) $(b + 2)(b^2 + 2b + 1)$

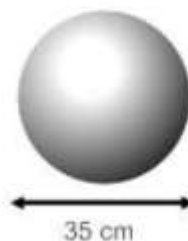
b) $(2x + 7)(x^2 + 9x + 3)$

c) $(y - 3)(y^2 - y + 2)$

d) $(3x - 1)(x^2 - 2x - 4)$

Volume

1. Calculate the volume of the sphere opposite which has a diameter of 35 cm.
Give your answer to 3 significant figures.



2. The Battle of Largs in 1263 is commemorated by a monument known as The Pencil.
This monument is shaped like a cylinder with a cone on top.

The cylinder has diameter 3 metres and a height 15 metres.

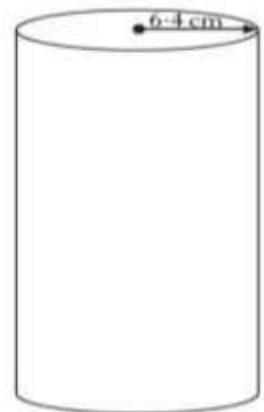
- a) Calculate the volume of the **cylinder part** of The Pencil.

The volume of the **cone** part of The Pencil is 5.7 cubic metres.

- b) Calculate the total **height** of The Pencil.

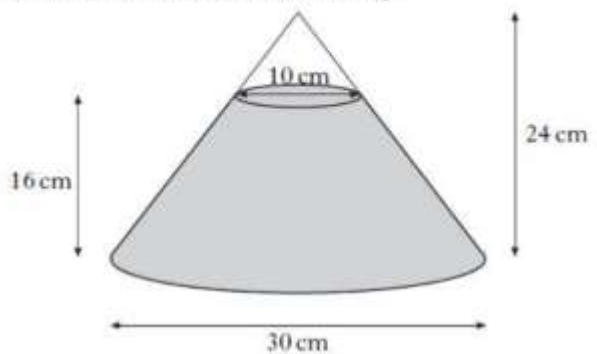


3. A cylindrical container has a volume of 3260 cubic centimetres.
The radius of the cross-section is 6.4 centimetres.
Calculate the height of the cylinder.

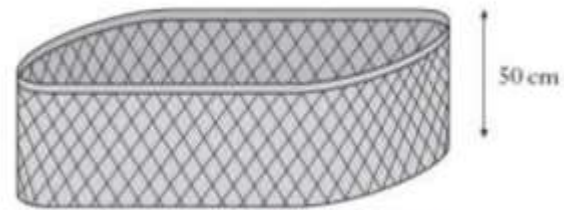


4. A glass ornament in the shape of a cone is partly filled with coloured water.

The cone is 24 centimetres high and has a base of diameter 30 centimetres.
The water is 16 centimetres deep and measures 10 centimetres across the top.
What is the volume of the water?
Give your answer to 2 significant figures.

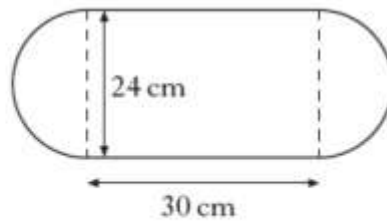


5. Jim Reid keeps his washing in a basket. The basket is in the shape of a prism.



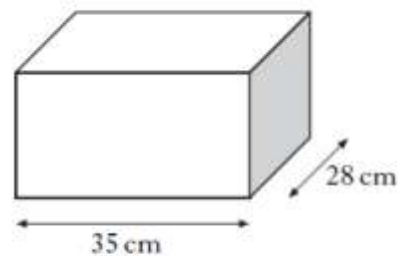
The height of the basket is 50 centimetres.

The cross section of the basket consists of a rectangle and two semi-circles as shown.



- a) Find the volume of the basket in cubic centimetres.
Give your answer correct to 3 significant figures.

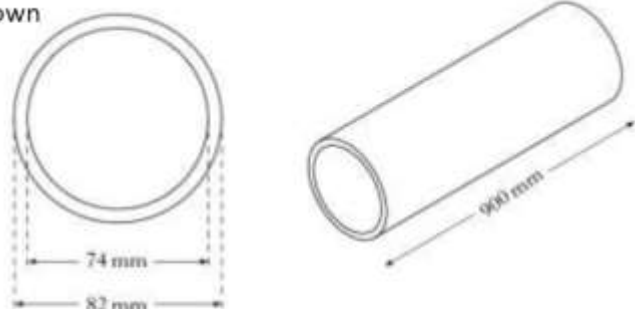
Jim keeps his ironing in a storage box which has a volume **half** of that of the basket.



The storage box is in the shape of a cuboid, 36 centimetres long and 28 centimetres broad.

- b) Find the height of the storage box.

6. A company manufactures aluminium tubes.
The cross-section of one of the tubes is shown in the diagram below.



The inner diameter is 74 millimetres

The outer diameter is 82 millimetres

The tube is 900 millimetres long

Calculate the volume of aluminium used to make the tube

Give your answer to 3 significant figures.

Functions

1. $f(x) = 3x + 7$. Find the value of (i) $f(3)$ (ii) $f(-2)$
2. $g(x) = 4x - 5$. Find the value of (i) $g(8)$ (ii) $g(-1)$
3. $h(x) = 3x^2 + 2$. Find the value of (i) $h(4)$ (ii) $h(-5)$
4. $f(x) = x^3 + 3x^2 - 5$. Find the value of $f(3)$
5. $f(x) = \frac{1}{2}x^3 + 3x - 4$. Find the value of $f(-2)$
6. $f(x) = 5x - 4$.
 - (a) Find the value of $f(3)$
 - (b) Given $f(a) = 21$, find the value of a .
7. $g(x) = 4x^2$.
 - (a) Find the value of $g(-6)$
 - (b) Given $g(a) = 64$, find two values for a .
8. $f(x) = 2x^2 - 7$.
 - (a) Find $f(-5)$.
 - (b) Given $f(c) = 193$, find two values for c .
9. $f(x) = 5x + 3$ and $g(x) = 7x - 11$. Given that $f(x) = g(x)$, find x .
10. $f(x) = 4x + 5$ and $g(x) = 2x - 3$. Given that $f(x) = 3g(x)$, find x .

Rearranging Formula

Express each of the following in terms of the letter given inside the square brackets.

- | | | | |
|-------------------------------|-----|-------------------------------|-----|
| 1) $P = A^2c - 6$ | [A] | 2) $K = 3x + 2y$ | [x] |
| 3) $P = q + 2u^2$ | [u] | 4) $H = 3(A + B)$ | [B] |
| 5) $x = 2y^2 - m$ | [y] | 6) $K = \frac{m^2n}{p}$ | [m] |
| 7) $\frac{x}{c} + a = b$ | [x] | 8) $q + 2\sqrt{a} = p$ | [a] |
| 9) $m = \frac{3x+2y}{p}$ | [y] | 10) $H = \frac{1}{L^2}$ | [L] |
| 11) $A = \frac{1}{3}P(Q + R)$ | [P] | 12) $U = \frac{1}{2}A(B + C)$ | [B] |
| 13) $A = g + \frac{h}{k}$ | [k] | 14) $A = \pi r^2h + 2\pi r^2$ | [h] |

Straight Line

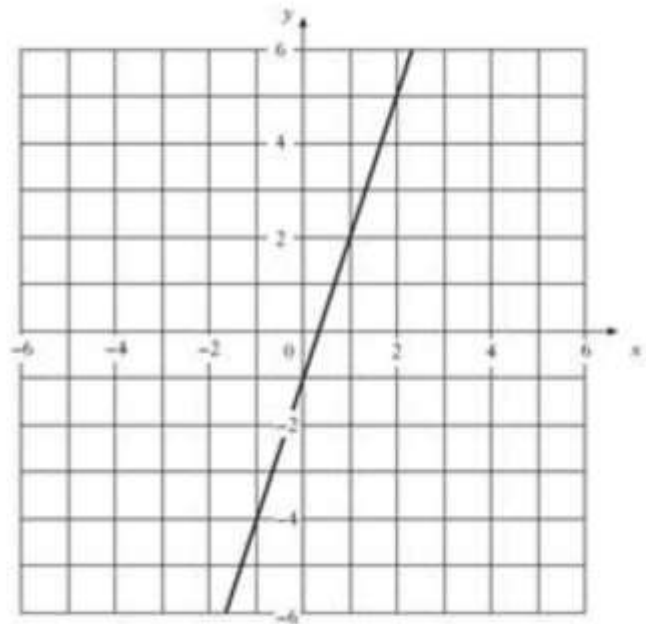
1. Calculate the gradient of the line joining:

- | | |
|-------------------------|------------------------|
| a) (2, 5) and (-1, -4) | b) (1, 5) and (-2, -1) |
| c) (6, -1) and (12, -3) | d) (8, 4) and (4, 3) |

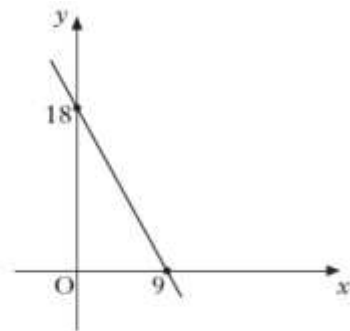
2. Find the gradient and y-intercept of the following straight lines:-

- | | | |
|------------------|-----------------|-----------------------|
| a) $y = 3x + 4$ | b) $y = 8 - 4x$ | c) $3y = 6x + 9$ |
| d) $x - 2y = 10$ | e) $3y = x$ | f) $5x - 10y - 4 = 0$ |

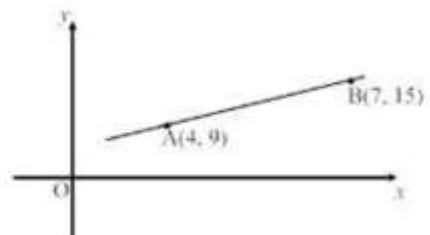
3. Find the equation of the line in the diagram below.



4. A straight line cuts the x -axis at the point $(9, 0)$ and the y -axis at the point $(0, 18)$ as shown. Find the equation of this line.



5. Find the equation of line AB as shown in the diagram below.



6. Find the equation of the line which passes through the points $(1, -3)$ and $(-3, 5)$

Fractions

1. Simplify the following:

a) $\frac{15}{20}$ b) $\frac{7}{91}$ c) $\frac{26}{39}$ d) $\frac{56}{63}$ e) $\frac{13}{39}$

2. Change the following to mixed numbers in their simplest form:

a) $\frac{80}{7}$ b) $\frac{60}{9}$ c) $\frac{174}{3}$ d) $\frac{76}{8}$ e) $\frac{33}{21}$

3. Find:

a) $\frac{3}{4} + \frac{5}{6}$ b) $\frac{7}{8} - \frac{3}{5}$ c) $\frac{5}{16} \times \frac{6}{7}$ d) $\frac{7}{9} \div \frac{2}{3}$

e) $1\frac{7}{10} + \frac{8}{9}$ f) $7\frac{1}{2} - 1\frac{5}{6}$ g) $4\frac{4}{5} \times 1\frac{1}{8}$ h) $4\frac{7}{8} \div 1\frac{6}{7}$

i) $1\frac{3}{5} + 2\frac{4}{7}$ j) $3\frac{1}{6} \div 1\frac{2}{3}$ k) $4\frac{1}{3} - 1\frac{1}{2}$ l) $\frac{2}{3}$ of $(\frac{4}{5} - \frac{1}{2})$

m) $\frac{1}{3}$ of $(\frac{5}{6} + \frac{2}{3})$ n) $1\frac{1}{2}$ of $(\frac{2}{3} + \frac{1}{4})$ o) $\frac{3}{5}$ of $(1\frac{3}{5} - \frac{2}{7})$ p) $\frac{4}{5}$ of $(9 \div \frac{2}{3})$

Percentages (Exam Type Questions)

1. Joseph invests £4500 in a bank that pays 6.4% interest per annum.
If Joseph does not touch the money in the bank, how much interest will he have gained after 3 years?
Give your answer to the nearest penny.
2. Jane bought a painting in an auction for £32 250.
Unfortunately the painting depreciated in value by 7% each year.
Calculate how much the painting was worth after 2 years.
Give your answer to 3 significant figures.
3. **Non calculator**
Last year (2008) a company made a profit of £1 000 000. This year (2009) it expects to increase its profit by 20% and by 2010 to have increased it by a further 25%.
Calculate the profit the company expects to make in 2010.
4. A patient in hospital is given 200mg of a drug at 0900. 12% of the amount of the drug at the beginning of each hour is lost, through natural body processes, by the end of that hour.
How many mg of the drug will be **lost** by 1200?
5. Holly buys an antique watch costing £1200. The watch appreciates in value by 3.7% per annum.
How much will the watch be worth in 4 years time?
Give your answer to the nearest pound.
6. A local council recycles 28 000 tonnes of glass each year. After a publicity campaign they expect to increase the amount of glass recycled by 12% each year.
 - (a) How much glass do they expect to recycle in 3 years time?
Give your answer correct to **3 significant figures**.
 - (b) The council aim to double the amount of glass recycled in 6 years.
If this rate is maintained, will the council meet their target?
Give a reason for your answer.

7. **Non calculator**

Arthur's new car cost him £15 000. The value of it will depreciate by 20% each year. How much will Arthur's car be worth when he trades it in for a new one in 2 years time?

8. Barry bought a house last year costing £115 000. This year it is valued at £110 400.

(a) Calculate the percentage decrease in the value of the house.

(b) If the value of the house continues to decrease at this rate what will the house be worth in a further 3 years time? Give your answer to 3 significant figures.

9. Marcus invested £3000 in a bank which paid 2.5% interest per year.

(a) Calculate how much money Marcus would have in his account after 3 years.

(b) How long would it take for Marcus' money to increase by 12%?

10. In 2007 a company made a profit of £45 000. Over the next three years its profit dropped by 3% each year due to increased manufacturing costs.

Calculate, correct to 3 significant figures, the company's profit in 2010.

11. The value of an industrial machine is expected to decrease each year by 14.2% of its value at the beginning of the year.

If it was valued at £15500 at the **beginning** of 2011, what will its expected value be at the **end** of 2013? **Give your answer correct to the nearest pound.**

Percentages - Reverse the Change

1. A student pays an aeroplane fare of £240.

If this represents 60% of the adult fare, find the adult fare.



2. In a maths examination Michael scored 75% of what Brian scored. If

Michael scored 66 marks, what did Brian score?

3. A classical concert is attended by 640 people on a Friday evening.

That evening 80% of the tickets had been sold. How many people can the venue hold when full?



4. Amanda and Roomila decide to see who can cycle further in an hour. Amanda covers 6.3 kilometres which is 70% of the distance covered by Roomila. How far did Roomila cycle?

5. The cost of a season ticket for Hillside Town is £273 for a child. If this represents 65% of the cost of an adult ticket, find the cost of an adult season ticket.



6. Neil and Jim are both teachers. Neil earns £32400 per annum. This is 90% of what Jim earns. How much does Jim earn per annum?

7. Between the years 2009 and 2010 a stereo system increased in value by 30%. If the stereo cost £650 in 2010 what was its value in 2009?



8. A can of cola contains 396 millilitres. This is 20% more than a normal sized can. How much does a normal can of cola hold?



9. The price of a car has increased in value by 40%. If the car is now valued at £10080 what was its previous value?



10. Vincent buys a painting at auction. He pays £1449 in total for the painting. This price includes auction commission of 15%. How much was the price of the painting before the commission was added?



11. The average cost of a computer has fallen in price by 65% since 1999. If the average cost is now £560, find the average cost in 1999.



12. David takes his family out for a meal. The total bill for the meal is £71.50. This cost includes a service charge of 10%.
What was the cost of the meal before the service charge was added?



13. A bottle of perfume contains 230 millilitres. This is 15% more than a normal bottle.
How much does a normal bottle hold?



14. In a sale, all MP4 players are reduced in price by 25%.
The MP4 player shown opposite now costs £135.
What was the original price of the MP4 player?



15. Elaine receives a letter from her insurance company saying her car insurance premium for the year 2012 is £648.
This is an increase of 35% on last years insurance.
How much did Elaine pay to insure her car in the year 2011?



16. A pack of soap powder contains 3.75 kilograms.
This is 50% bigger than a normal size pack.

How much does a normal size pack hold?



17. Javaid books a holiday to Paris for himself and his two children. The total cost of the holiday is £1323.
This cost includes a booking fee of 5%.

What is the cost of the holiday before the booking fee is added?



18. The roll of a school has fallen this year to 1190. This means the roll is 15% less than it was last year.
What was the school roll last year?

19. In one area of England the number of badgers is estimated at 15 400. This is a fall of 30% from last year. How many badgers were there last year in this area?

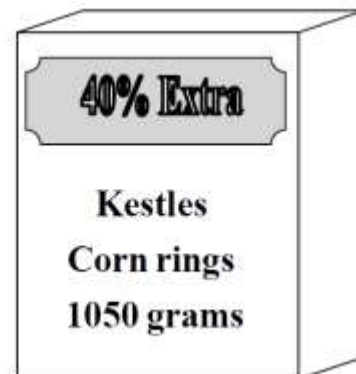


20. Renco coffee are selling a jar of coffee with a special offer of an extra 12.5%. The jar now contains 270 grams.
How much does the original jar contain?



21. Kestles are selling a box of corn rings containing an extra 40%. The box now contains 1050 grams of corn rings.

How much did the box contain before the 40 % was added?



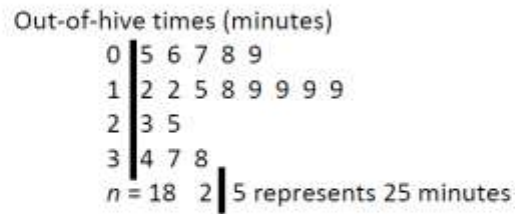
Statistics

1. A Quality Control Inspector selects a random sample of seven matchboxes produced by Machine A and records the number of matches in each box:

54 45 51 50 48 53 49

- For the given data calculate the mean and the standard deviation
- Machine B was also sampled. The data gave a mean of 52 matches and a standard deviation of 1.6 matches. Compare the results of the two machines justifying your comparisons.

2. A biologist was studying the length of time it took bees to return to their hive. These 'out-of-hive' times are shown in this stem and leaf diagram.

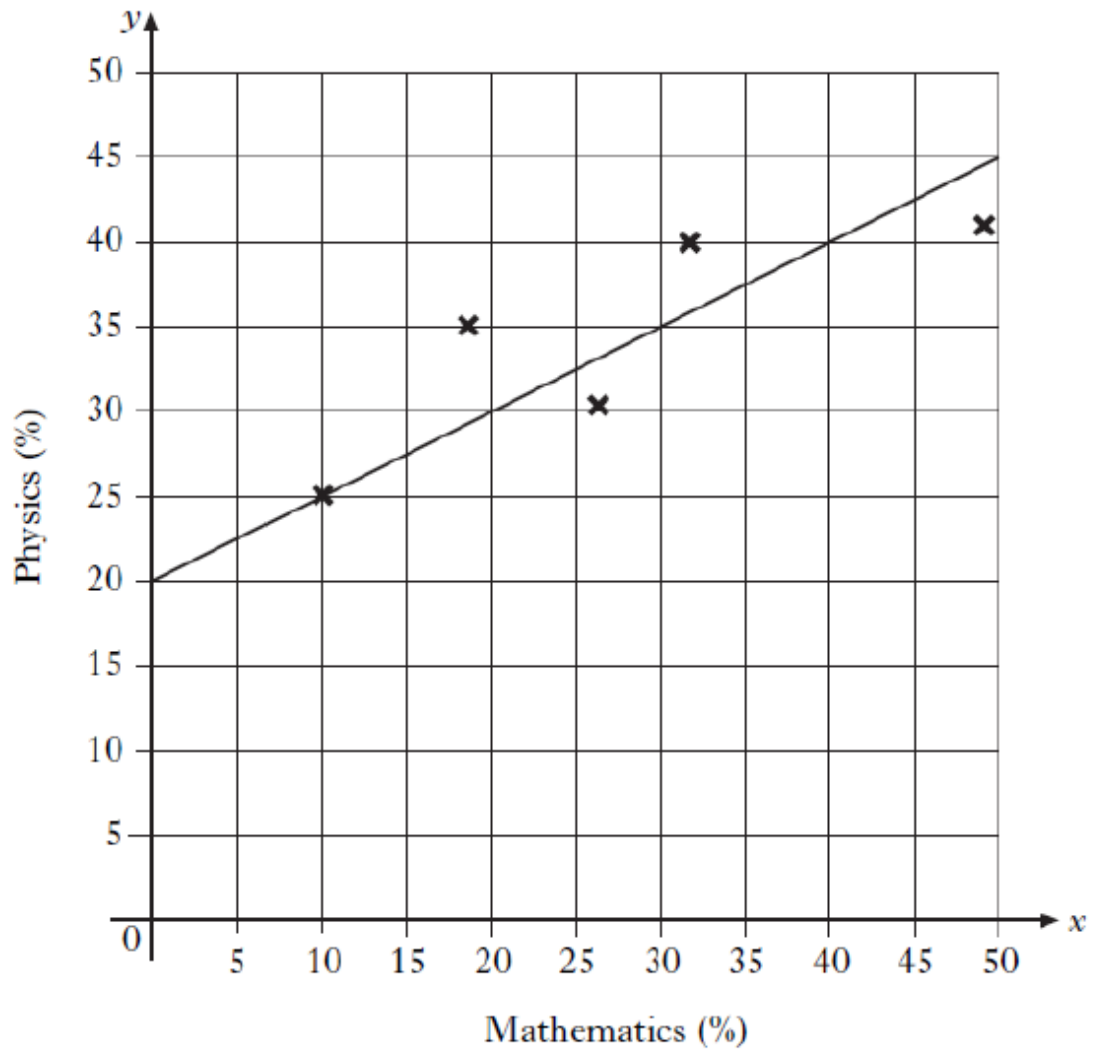


- a) From the above data find the five figure summary
 - b) Construct a box plot
 - c) Calculate the SIQR
3. The results for a group of students who sat tests in mathematics and physics are shown below.

<i>Mathematics (%)</i>	10	18	26	32	49
<i>Physics (%)</i>	25	35	30	40	41

- a) Calculate the standard deviation for the mathematics test.
- b) The standard deviation for physics was 6.8.
Make an appropriate comment on the distribution of marks in the two tests.

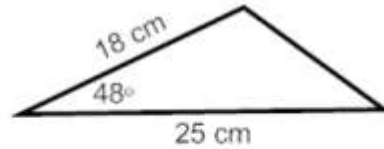
These marks are shown on the scattergraph below.
A line of best fit has been drawn.



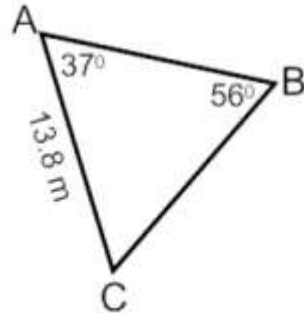
c) Find the equation of the line of best fit.

Trigonometry

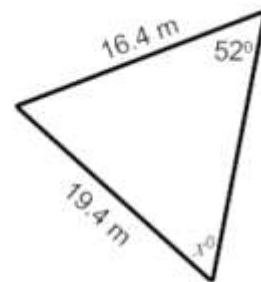
1. Calculate the area of the triangle opposite
Give your answer to 3 significant figures.



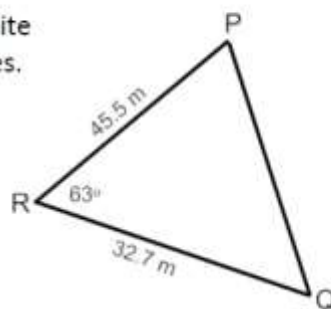
2.
a) Length of side AB in the triangle opposite
Give your answer to 3 significant figures.



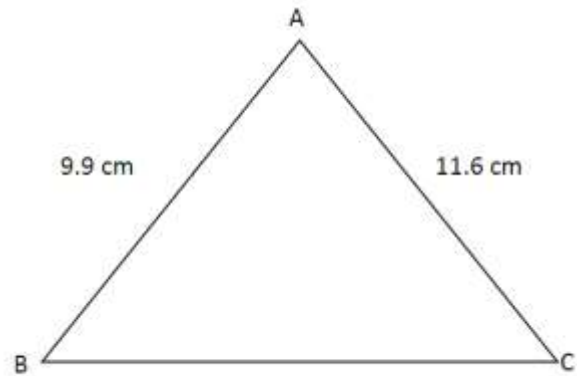
- d) Another pupil scored 76% in the mathematics test but was absent from the physics test.
Use your answer in part c) to predict his physics mark.
b) The size of angle marked x° in the triangle opposite
Give your answer to 3 significant figures.



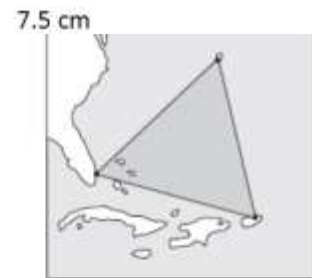
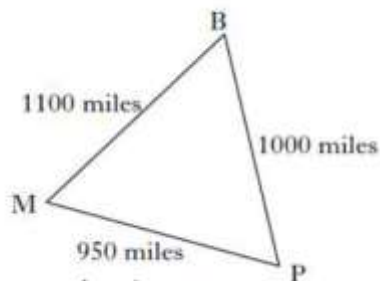
3.
a) Length of side PQ in the triangle opposite
Give your answer to 3 significant figures.



- b) Angle BAC in the triangle opposite
Give your answer to 3 significant figures.

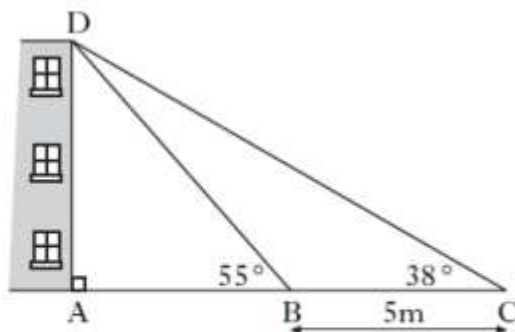


4. The Bermuda triangle is an area in the Atlantic Ocean where many planes and ships have mysteriously disappeared
It vertices are at Bermuda (B), Miami (M) and Puerto Rico (P)



Calculate the size of angle BPM.

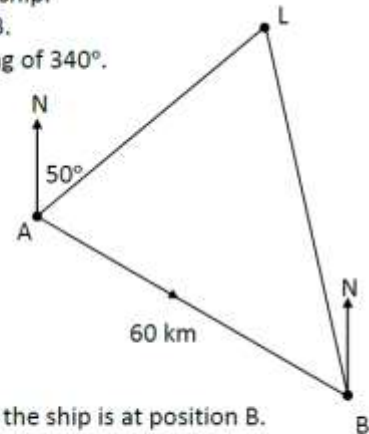
5. For the reasons of safety, a building is supported by two wooden struts, represented by DB and DC in the diagram below.



Angle ABD = 55° .
Angle BCD = 38° .
BC is 5 metres.

Calculate the height of the building represented by AD.

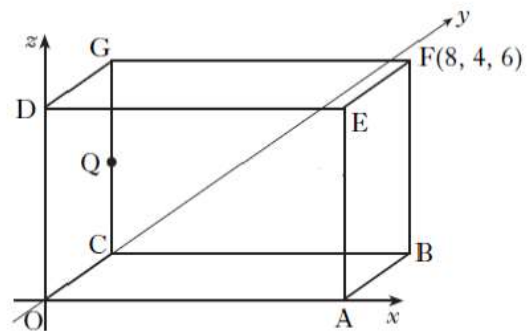
6. A ship is at position A. Lighthouse L is on a bearing of 050° from the ship. The ship then travels 60 kilometres on a bearing of 130° to position B. From position B the captain now observes the lighthouse on a bearing of 340° .



Calculate the distance between the ship and the lighthouse when the ship is at position B.

Vectors

1. The diagram shows a cuboid OABC, DEFG. F is the point (8, 4, 6). Q is the midpoint of CG.



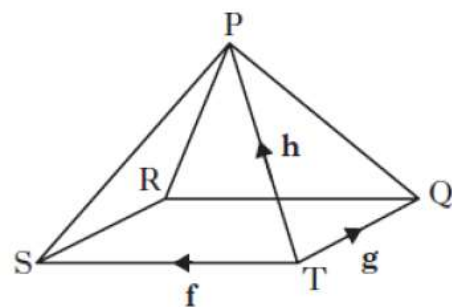
State the coordinates of E and Q.

2. Given that $\mathbf{u} = \begin{pmatrix} 2 \\ 0 \\ 1 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} -1 \\ 2 \\ 4 \end{pmatrix}$, find $3\mathbf{u} - 2\mathbf{v}$ in component form.

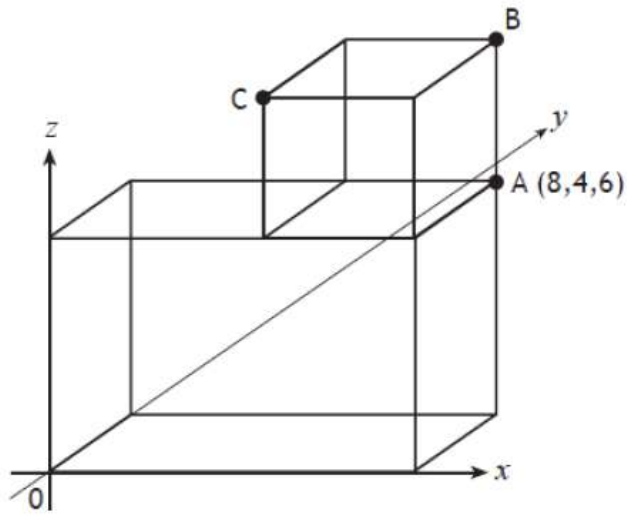
3. The diagram shows a square-based pyramid PQRST.

\vec{TS} , \vec{TQ} and \vec{TP} represent \mathbf{f} , \mathbf{g} and \mathbf{h} respectively.

Express \vec{RP} in terms of \mathbf{f} , \mathbf{g} and \mathbf{h} .



4. The diagram shows a cube placed on top of a cuboid, relative to the coordinate axes.



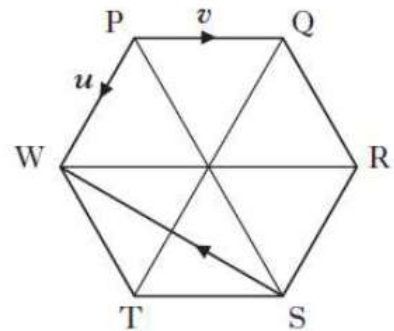
A is the point $(8, 4, 6)$.

Write down the coordinates of B and C.

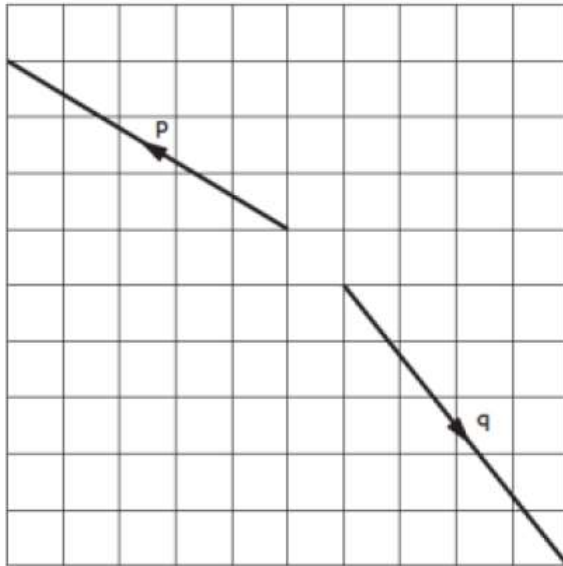
5. The diagram shows a regular hexagon PQRSTW.

\vec{PW} and \vec{PQ} represent vectors \mathbf{u} and \mathbf{v} respectively.

What is \vec{SW} in terms of \mathbf{u} and \mathbf{v} ?



6. The vectors \mathbf{p} and \mathbf{q} are shown in the diagram below.
Find the resultant vector $\mathbf{p} + \mathbf{q}$.
Express your answer in component form.



7. Vector \mathbf{u} has the components $\begin{pmatrix} 1 \\ 3 \\ 1 \end{pmatrix}$ and \mathbf{v} has the components $\begin{pmatrix} 1 \\ 0 \\ -2 \end{pmatrix}$.
Find the magnitude of $2\mathbf{u} - \mathbf{v}$.

8. Two forces acting on a rocket are represented by vectors \mathbf{u} and \mathbf{v} .

$$\mathbf{u} = \begin{pmatrix} 2 \\ -5 \\ -3 \end{pmatrix} \text{ and } \mathbf{v} = \begin{pmatrix} 7 \\ 4 \\ -1 \end{pmatrix}.$$

Calculate $|\mathbf{u} + \mathbf{v}|$, the magnitude of the resultant force.
Express your answer as a surd in its simplest form.

9. In the trapezium $AB = 2DC$ and AB is parallel to DC

In terms of \mathbf{u} and \mathbf{v} , write down the vectors

- (a) \overrightarrow{AB} (b) \overrightarrow{AC} (c) \overrightarrow{BC} (d) \overrightarrow{AN}

