S4 October Revision Sheet
Block Test 1

Non-Calculator

(1) Multiply out and collect like terms:

      (a) $5(2x - 4)$ (b) $(5x - 3)(2x - 4)$ (c) $(2x - 3)(x^2 - 5x - 2)$

(2) Factorise fully:

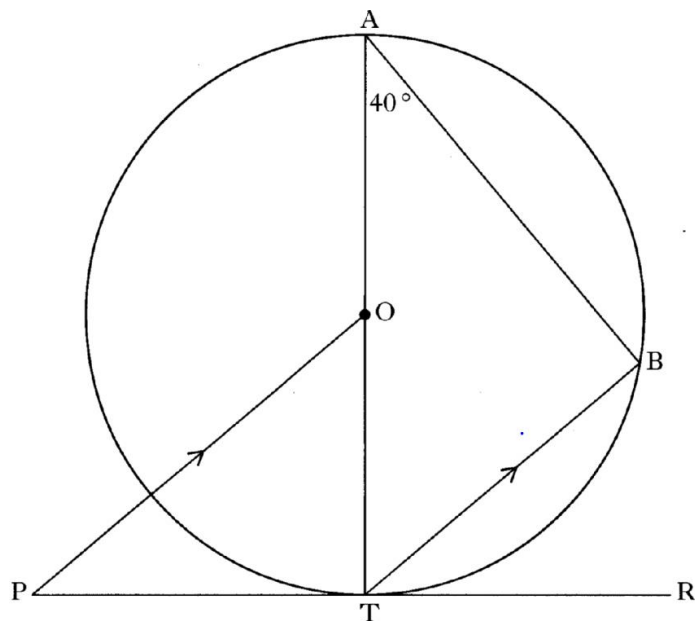   (a) $x^2 - 6x$ (b) $100 - p^2$ (c) $x^2 - 13x + 30$ (d) $5x^2 - 9x + 4$

(3) Express $\dfrac{3}{x-1} + \dfrac{4}{x+1}$, $x \neq 1$, $x \neq$ -1 as a single fraction in its simplest form.

(4) Express $\dfrac{5(2x-3)}{4x^2-9}$ in its simplest form.

(5) Change the subject of the formula $P = q + 2r^2$ to r.

(6) Solve the inequality $11 - 2(1 + 3x) < 39$.

(7)

PTR is a tangent to a circle, centre O.
Angle BAT = 40⁰.
PO is parallel to TB.
Calculate the size of angle OPT.
Show all working.

(8) Find:

(a) $2\frac{4}{5} + 3\frac{3}{4}$ (b) $5\frac{1}{3} - 2\frac{3}{4}$ (c) $2\frac{1}{3} \times 1\frac{1}{5}$ (d) $3\frac{5}{9} \div 2\frac{2}{3}$

(9) Find:

(a) $\frac{5}{6} - \frac{1}{5} \times \frac{5}{12}$ (b) $\frac{3}{4}\left(\frac{1}{3} + \frac{2}{7}\right)$

(10) $f(x) = 7 - 4x$

(a) Evaluate $f(-2)$.
(b) Given that $f(t) = 9$, find t.

(11) Express in its simplest form:

(a) $y^8 \times (y^3)^{-2}$ (b) $\dfrac{3a^5 \times 2a}{a^2}$ (c) $\dfrac{b^{\frac{5}{2}} \times b^{-\frac{1}{2}}}{b}$
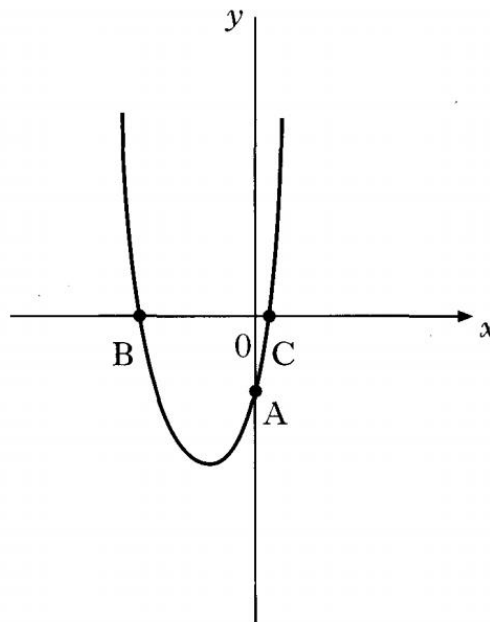
(12) Solve:

(a) $x^2 - 9x = 0$ (b) $x^2 - 81 = 0$ (c) $2x^2 + 9x - 5 = 0$

(13) The diagram below shows part of the graph of $y = 4x^2 + 4x - 3$.
The graph cuts the y-axis and the x-axis at B and C.

(a) Write down the coordinates of A.
(b) Find the coordinates of B and C.
(c) Calculate the minimum value of $4x^2 + 4x - 3$.

(14) It is planned to build a warehouse 160 metres from a park.
The warehouse will be 20 metres high.
The warehouse is to be hidden from the park by planting trees which will grow to a height of 15 metres, as shown.

PARK

20 m
Warehouse

15 m

160 m
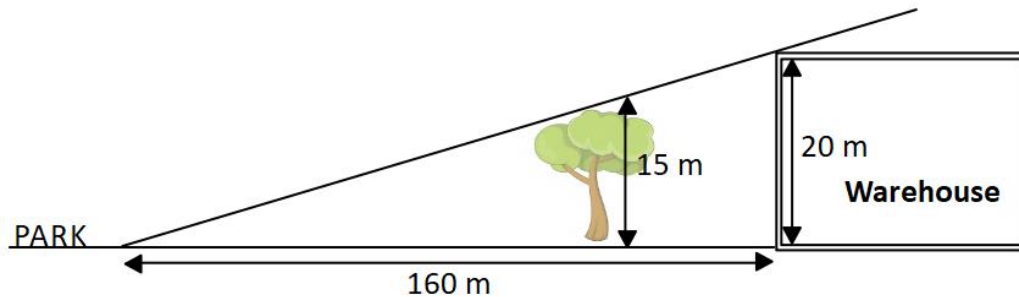
How far from the park should the trees be planted?

(15) Find the point of intersection of the straight lines with equations $2x + y = 5$ and $x - 3y = 6$.

(16) The midday temperatures in Grantford were recorded over a nine day period.
The temperatures, in °C, were

| 4 | 7 | 4 | 3 | 6 | 10 | 9 | 5 | 3 |

(a) Calculate the median and semi-interquartile range for these temperatures.

Over the same nine day period, the midday temperatures in Endoch were also recorded.
The median temperature was 8°C, and the semi-interquartile range was 1.5°C.

(b) Make two valid comments comparing the midday temperatures of Grantford and Endoch during this period.

(17) The cost of a journey with Tom's Taxis depends on the distance travelled. The graph below shows the cost, P pounds, of a journey with Tom's Taxis against the distance travelled, d miles.

Point A represents a journey of 8 miles which costs £14.
Point B represents a journey of 12 miles which costs £20.

(a) Find the equation of the line in terms of P and d.
Give the equation in its simplest form.
(b) Calculate the cost of a journey of 5 miles.
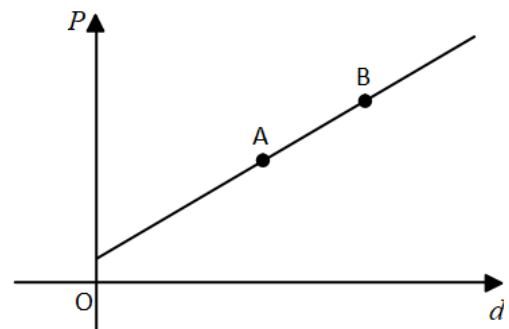
(18) Find the equation of the line joining the points (-2,5) and (3,15).
Give the equation in its simplest form.

(19) A straight line has equation $2y + 3x = 12$.

      (a) Find the gradient of this line.
      (b) The line crosses the y-axis at $(0,c)$.
          Find the value of c.

(20) Simplify:

      (a) $4\sqrt{3} - \sqrt{27}$ (b) $\sqrt{24} + \sqrt{600}$
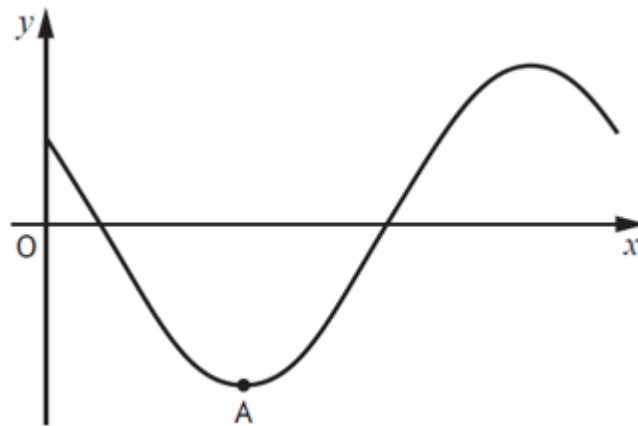
(21) Express with a rational denomninator in its simplest form:

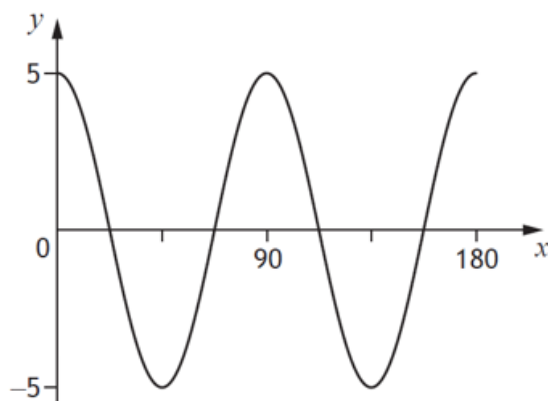   (a) $\dfrac{1}{\sqrt{3}}$ (b) $\dfrac{6}{\sqrt{2}}$ (c) $\dfrac{10}{3\sqrt{5}}$

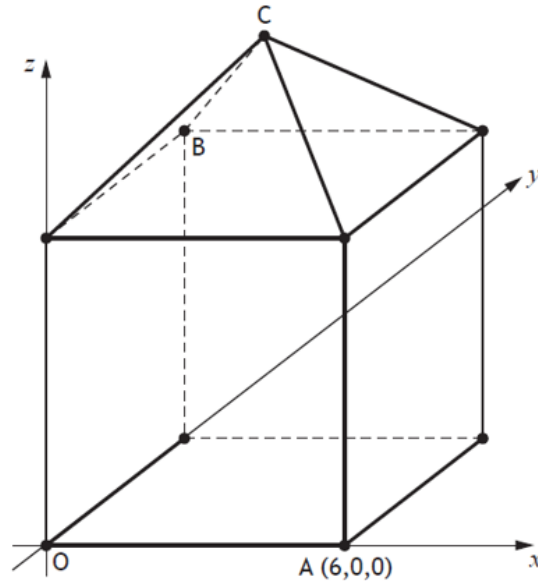(22) Part of the graph of $y = 3\cos(x + 45)°$ is shown in the diagram.

      The graph has a minimum turning point at A.
      State the coordinates of A.

(23) Part of the graph of $y = a\cos bx°$ is shown in the diagram.

      State the values of a and b.

(24) The diagram shows a square-based pyramid placed on top of a cube, relative to the coordinate axes.

The height of the pyramid is half of the height of the cube.
A is the point (6,0,0).
The point C is directly above the centre of the base.
Write down the coordinates of B and C.

(25) The diagram below shows parallelogram ABCD.
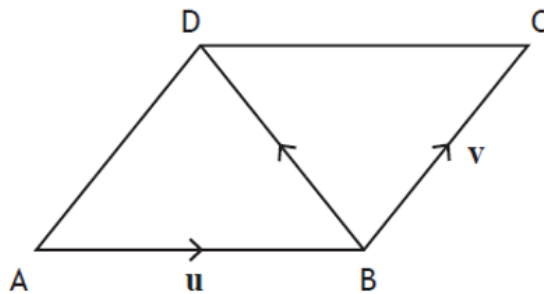
$\overrightarrow{AB}$ represents vector **u** and $\overrightarrow{BC}$ represents vector **v**.
Express $\overrightarrow{BD}$ in terms of **u** and **v**.

(26) Two forces acting on a rocket are represented by vectors **u** and **v**.

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

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

(27) The diagram below represents a sphere.
The sphere has a diameter of 6 centimetres.
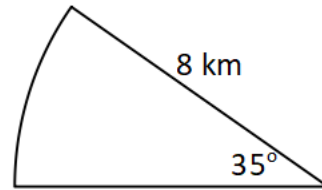Calculate its volume.
Take π = 3.14.

6 cm
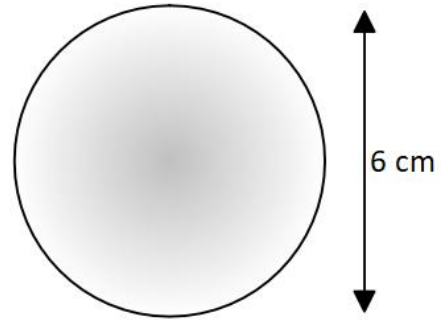
Calculator

(1) The diagram shows a table.
The table is in the shape of a circle with a straight edge.
The radius OA of the table is 50 cm and AB is 72 cm.
Calculate w, the width of the table.
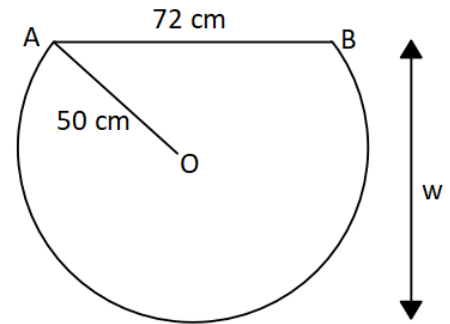
(2) The beam from a lighthouse reaches a
distance of 8 kilometres and spreads to
an angle of 35ᵖ.
Calculate the area covered by the beam from the
lighthouse.

(3) The curved part on an anchor is in the shape
of an arc of a circle which has radius 1.2 metres.
Calculate the length of this arc.
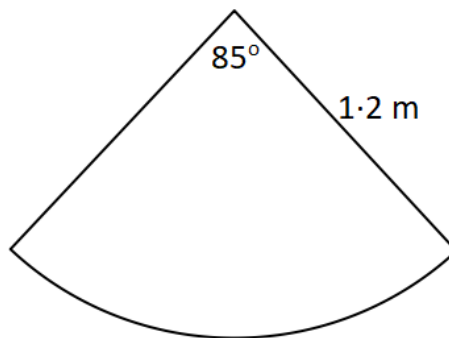
(4) At 1 pm, a pan containing 1.3 litres of water, is left on the window sill of a house.
The water in the pan evaporates at a rate of 11% per hour.
How much water remained in the pan at 5 pm?

(5) The population of a Scottish village has dropped by 35%. If the population is now 420, what was
the population originally?

(6) The diagram below shows the position of three towns. Lowdown is due west of Midtown. The
distance from:
- Lowtown to Midtown is 75 kilometres.
- Midtown to Hightown is 110 kilometres.
- Hightown to Lowtown is 85 kilometres.

Is Hightown directly North of Lowtown?
Justify your answer.

(7) Chris wants to store his umbrella in a locker.
The locker is a cuboid with internal dimensions of length 40 centimetres, breadth 40 centimetres and height 70 centimetres.
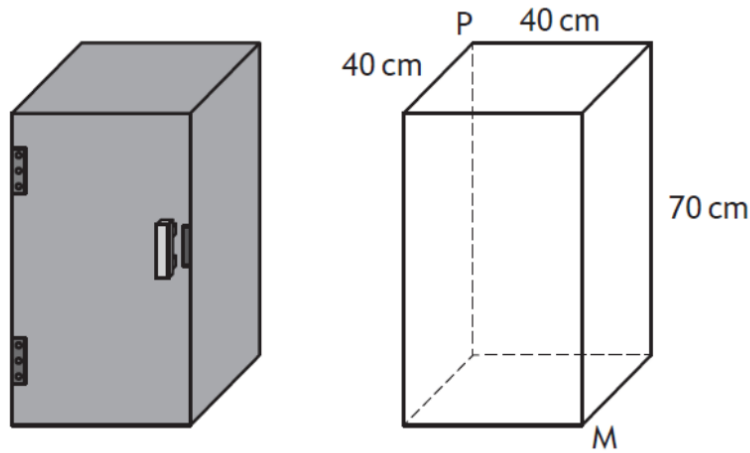
The umbrella is 85 centimetres long.
He thinks it will fit into the locker from corner P to corner M.
Is he correct?
Justify your answer.

(8) Solve the equation $x^2 + 3x - 5 = 0$.
Give your **answer correct to 2 significant figures**.

(9) Solve the equation $2p^2 - 3p - 1 = 0$.
Give your answer **correct to 1 decimal place**.

(10) A test tube contains 3×10^4 cubic millimetres of water. If each cubic millimetre of water contains 1.75×10^3 bacteria, how many bacteria are in the test tube?
Give your answer in scientific notation.

(11) There are 6.02×10^{23} particles in one mole of carbon.
How many particles are there in 700 moles of carbon?
Give your answer in scientific notation.

(12) The pitchers shown opposite are similar.
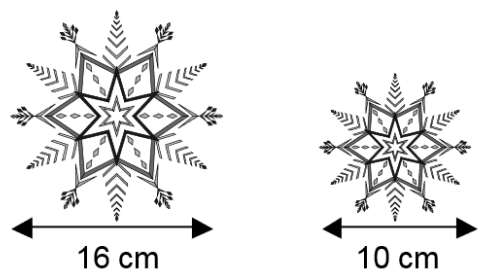The larger pitcher can hold 864 ml of liquid.
How much liquid can the smaller pitcher hold?

(13) Two Christmas decorations are mathematically similar in shape.
The larger decoration has an area of 128 cm^2.
Calculate the area of the smaller decoration.

(14) A toy shop sells teddy bears and rabbits.

(a) Two rabbits and three bears cost £84.
Write down an equation to illustrate this information.
(b) Three rabbits and two bears cost £76.
Write down an equation to illustrate this information.
(c) Find the cost of one rabbit teddy and one teddy bear.

(15) (a) The number of pupils in seven third year classes in a secondary school are

25   24   28   22   24   30   22

Calculate the mean and standard deviation of the class sizes.

(b) In the same school the mean and standard deviation of the number of pupils in seven fourth year classes are 22 and 4.4 respectively.

Make two comparisons between the class sizes in third year and in fourth year.

(16) The first three holes on a golf course are shown in the diagram opposite. Calculate the distance from the second to the third hole.

375 m

80°

1

482 m

2

3
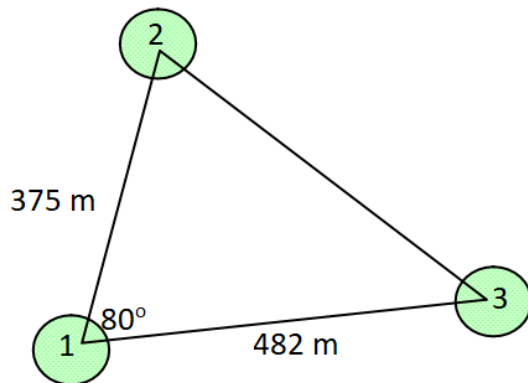
(17) Three markers P, Q and R are placed at the corners of a triangular field. Calculate the size of angle RPQ.

P

R

100°

85 m

108 m

Q
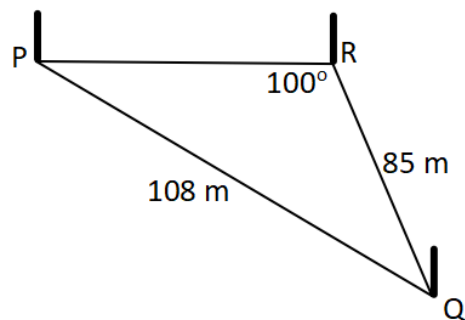
(18) A piece of metal was cut in the shape of a triangle. Calculate the area of this piece of metal.

130°

2 cm

7 cm
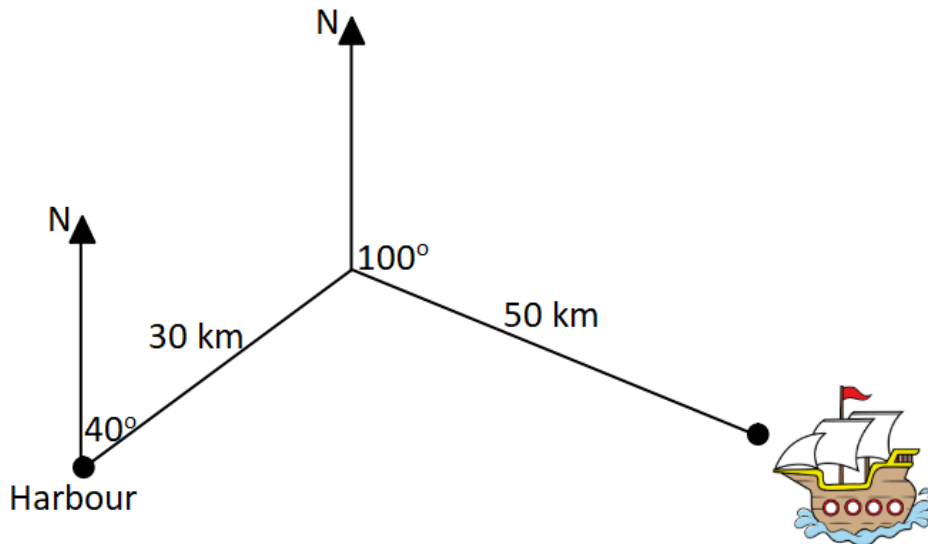
(19) From A, the angle of elevation to the top of a telegraph pole is 31°. From B, the angle of elevation to the top of the same pole is 50°.

31°
A
5·5 m
50°
B
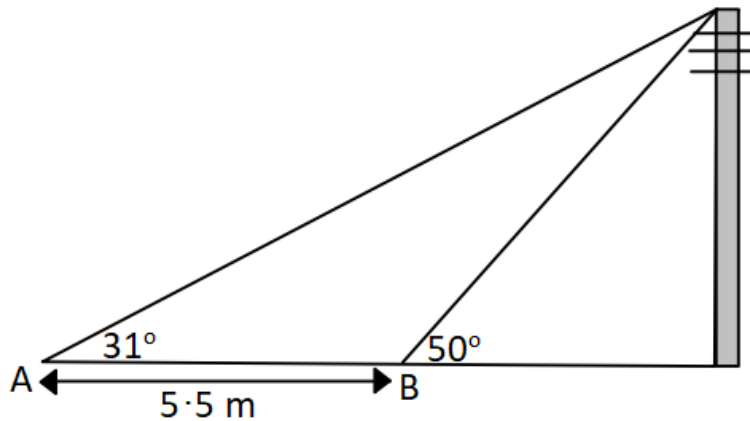
Calculate the height of the telegraph pole.

(20) The sketch below shows the journey of a ship from a harbour.

N

N
100°
50 km
30 km
40°
Harbour

The ship leaves the harbour and sails 30 km on a bearing of 040° and then sails 50 km on a bearing of 100°.

Calculate the distance the ship is from the harbour.

(21) The diagram shows a cylinder with a cone cut from it.
The cone and the cylinder both have radius 24 centimetres and height 40 centimetres.
Calculate the volume of the solid once the cone has been removed.

24cm

40cm
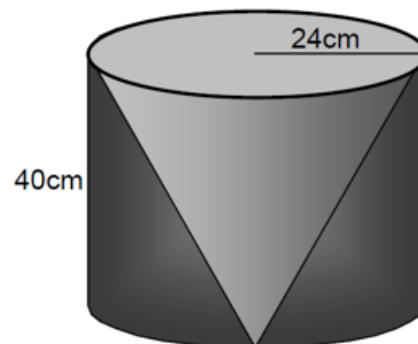
(22) A buoy is in the shape of a hemisphere with a cone on top, as shown opposite.

Calculate the volume of this buoy.

80cm

70cm