

Arithmetic

1) Express $\frac{64}{21}$ as a decimal, leaving your answer correct to 2 decimal places.

2) Estimate, correct to 1 significant figure, the value of $\frac{8.92 \times \sqrt{36.04}}{\sqrt[3]{-26.9}}$.

3) Evaluate $\frac{8.679 + 3.547}{9.35^2 - \sqrt{48.8}}$. Give your answer to 3 significant figures.

4) Express $23\frac{1}{7}\%$ as a fraction in its lowest term.

Prime Factor

- 5) The number 63 written as the product of its prime factors is $63 = 3^2 \times 7$.
- a) Write 324 as the product of its prime factors.
- b) Find the highest common factor of 63 and 324.
- c) Find the lowest common multiple of 63 and 324. Leave your answer in index notation

6a) Express 720 as a product of its prime number.

Find the smallest whole number k such that

6b) $720k$ is a perfect square.

6c) $\frac{720}{k}$ is a perfect cube.

7) An alarm clock rings every 60 minutes. Another alarm clock rings every 45 minutes. They ring together at 7 am. Find the next time they ring together.

8) The following items are to be packed into gift bags for distribution to an old folks' home. 84 packets of cereals, 126 cans of baked beans and 168 packets of biscuits.

The items are to be packed such that the contents in each gift bag are the same and there are no leftovers. Find

- a) the maximum number of gift bags required.
- b) the list of content in each gift bag.

Algebra

9) Factorise the following completely

a) $5 - 45t^2$

b) $10ax + 5by - 2ay - 25bx$

c) $3x^2 - 8x - 16$

10) Factorise the following completely

a) $2a^2 + 9ab - 5b^2$

b) $x^2y - 4y - 28 + 7x^2$

11) Simplify $\frac{3x}{5} - \frac{4(2-3x)}{7}$.

12) Express as a single fraction in its simplest form.

$$\frac{3}{m-2} - \frac{2}{3m-1}$$

13) Express as a single fraction in its simplest form

$$\frac{1}{m^2-1} - \frac{2}{m+1}$$

14) Solve the equation

$$\frac{3x + 1}{7} = -\frac{3 - x}{4}$$

15) Solve the equation

$$\frac{3}{2} - \frac{4}{x + 2} = \frac{5}{x - 1}$$

16) It is given that $sq^2 = r^2 + \frac{1}{2}ps$.

a) Evaluate q when $s = 3$, $r = -5$ and $p = 2.4$.

b) Express s in terms of p , q and r .

17a) Make b the subject of the formula $S = \frac{n(a+b^2)}{2}$.

17b) Hence, find the value(s) of b when $a = 8$, $n = 5$ and $S = 30$.

18a) Express $-x^2 + 6x + 1$ in the form $-(x - a)^2 + b$.

18b) Using the result from **(b)**, solve the equation $-x^2 + 6x + 1 = 0$

19a) Express $-x^2 + 4x - 1$ in the form $-(x - p)^2 + q$.

19b) Sketch the graph of $y = -x^2 + 4x - 1$

19c) Write down the equation of the line of symmetry.

20) Solve these simultaneous equations

$$2x + 3y = 11$$

$$5x + 4y = 10$$

21a) Solve the inequalities $8 + x < 10 + \frac{3}{2}x \leq 15.5 - 2x$.

21b) Hence, write down the largest rational number that satisfies

$$8 + x < 10 + \frac{3}{2}x \leq 15.5 - 2x$$

22) Simplify $\sqrt{\frac{64x^{-6}}{y^4}} \div \frac{x^5}{y^3}$, giving your answer in positive index.

23) Simplify $\frac{a^2b}{2} \times (2a^0b^{-2})^3$, leaving your answer in positive index form.

24) Given that $2^{5m} \times 6 = 384$, find m .

25) The height of h of a particular water container which has a constant volume is inversely proportional to the square its radius r cm

(a) Find the equation connecting h and r , given that $h = 4$ cm when $r = 5$ cm.

(b) Find the value of r when $h = 5$ cm.

26) z is directly proportional to the square of y .

a) When $z=3$, $y=5$.

Find the formula connecting z and y .

b) Find the values of y , given that $z=36$.

27) P is directly proportional to the cube of Q .

P is increased by 700%.

Calculate the percentage change in Q .

28) A map is drawn to a scale of 1 : 120 000

a) Calculate the actual distance, in km, represented by 6.3 cm on the map.

b) A lake has an actual area of 3.9 km^2 . Find the area of the lake on the map, in square centimetres.

29) On a map scale of 1 : 2000, a reservoir is represented by an area of 12 cm^2 .

a) Calculate the actual area, in square metres, of the reservoir.

b) On a second map, the reservoir is represented by an area of 75 cm^2 . Find the scale of this second map in the form 1 : n .

30) These are the first four terms in a sequence.

50 45 40 35

a) Write down the tenth term in the sequence

b) Write down an expression, in terms of n , for the n th term in the sequence.

31) These are the first four terms in a sequence.

2 9 16 23

a) Write down the 7th term of the sequence

b) Find an expression, in terms of n , for the n th term of the sequence.

32) Given that following sequence

$\frac{1}{38}, \frac{4}{39}, \frac{9}{40}, \frac{16}{41}, \frac{25}{42}, \dots$

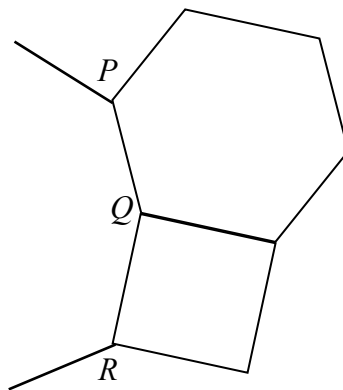
a) write down the next 4 terms

b) find an expression in terms of n , for the n th term of this sequence.

33a) A regular polygon has interior angles of 135° . Find the number of sides of the polygon.

33b) 8 interior angles of a 9-sided polygon are each 145° . Find the remaining angle.

34) The figure is made up of a square and a regular hexagon. PQ and QR are two sides of another regular polygon. Find



a) the reflex $\sphericalangle PQR$

b) the number of sides of this polygon.

35) Express 65 699 400 in standard form.

36) Express 0.000002854 in standard form.

37) A tuft of grass grows approximately 70 picometre in 1 millisecond.

Estimate how much the same tuft of grass will grow in 1 second.

Express your answer in metres expressed in standard form.

[pico = 10^{-12} and milli = 10^{-3}]

38) The cash price of a television set is \$1122.

The hire purchase price is a deposit of 15% of the cash price plus 12 equal monthly payments of \$90. Calculate the hire purchase price.

39) John eats at a restaurant. The bill is \$100 excluding service charge of 10% and GST of 9%. Calculate the final bill John has to pay.

40) Abby had an outstanding credit card bill with *ABC* bank.

The bank charges a compounded interest rate of 24% per year, compounded monthly.

After 3 months, the total extra interest she had to pay was \$92.

Calculate Abby's original outstanding credit card bill.

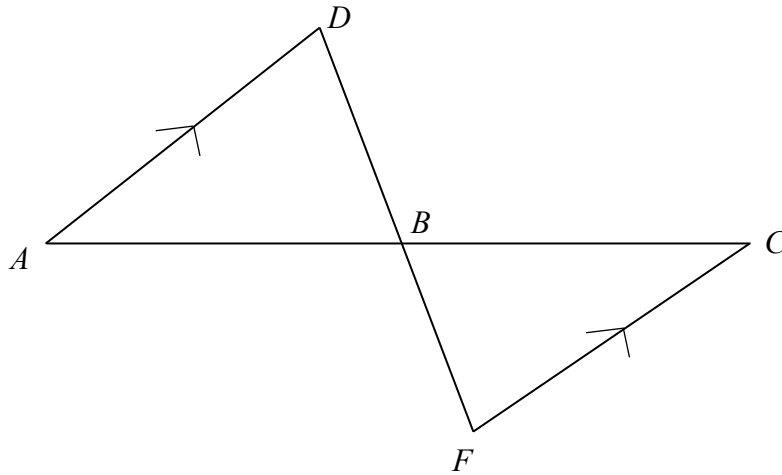
41) John deposited \$10 000 in bank paying an interest of 10% per annum, compounded half yearly. Calculate the amount of interest he would receive after 2 years.

42a) Mr Tan deposits \$9000 in a fund that pays compound interest of 2.5% per annum, compounded half-yearly.

Calculate the total amount of money that Mr Tan would have in the fund at the end of five years.

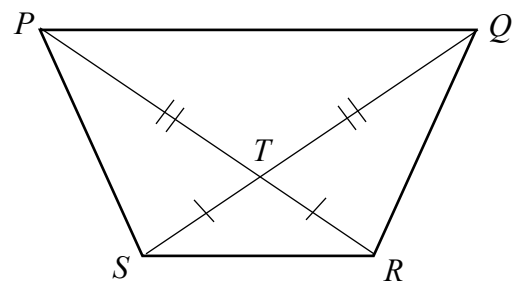
42b) At the end of five years, Mr Tan withdraws \$10 000 from the fund and saves this amount in a bank which offers a simple interest rate of 1.6% per annum. Find the minimum number of years he has to leave the money in the bank so that his total savings would amount to more than \$11 000. Leave your answer as an integer.

43) In the diagram, ABC and DBF are straight lines. AD is parallel to FC and $DB = FB$. Show that triangle ADB and triangle CFB are congruent.

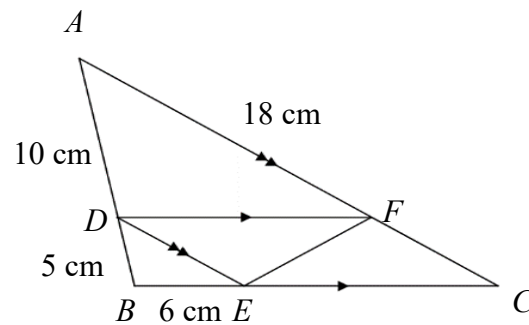


44) In the quadrilateral $PQRS$, the diagonals PR and QS intersect at T . $PT = QT$ and $ST = RT$.

- Prove that triangle PRS is congruent to triangle QSR .
- Name two other triangles that are congruent.
- Show that triangle PQT is similar to triangle RST . Hence show that $PQRS$ is a trapezium.

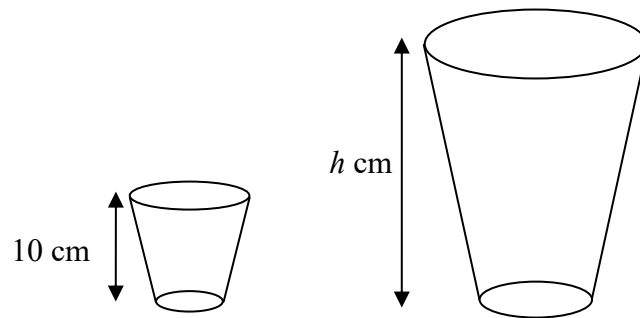


45) In the diagram, DF is parallel to BC and AC is parallel to DE . The points D , E and F lie on the line AB , BC and AC respectively. Given that $DB = 5$ cm, $AD = 10$ cm, $BE = 6$ cm and $AF = 18$ cm



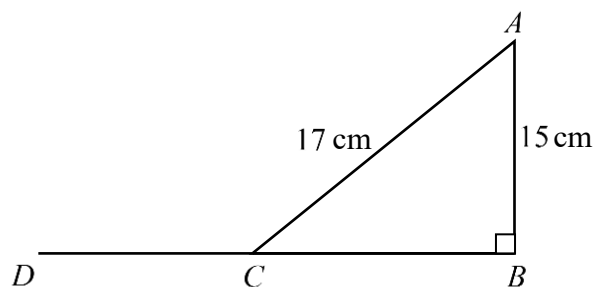
- Name a triangle that is similar to $\triangle ADF$, and prove that they are similar.
- Prove that $\triangle CEF$ is congruent to $\triangle DFE$.
- Find the length of BC
- Find the ratio of $\frac{\text{area of triangle } DBE}{\text{area of parallelogram } DECF}$, express your answer in fractions.

46) Two containers are geometrically similar. Given that the volume of the smaller container is 297 cm^3 and the volume of the bigger container is 1375 cm^3 .



- Find the ratio of the surface area of the smaller container to the larger container.
- If the height of the smaller container is 10 cm, find the height of the larger container, h cm.

47) In the diagram, $\angle ABC = 90^\circ$, $AB = 15 \text{ cm}$, $AC = 17 \text{ cm}$ and BCD is a straight line.

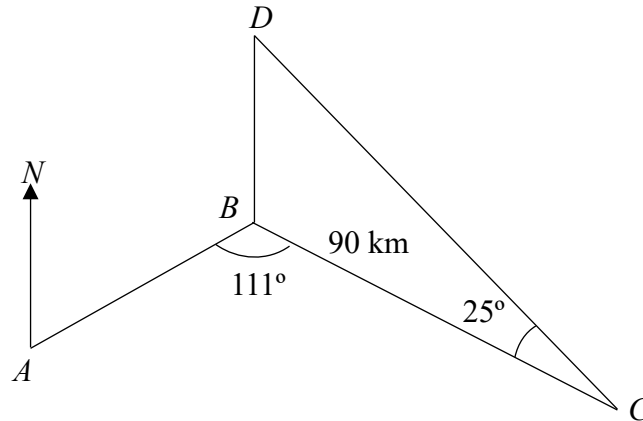


- Find the length of BC .

Express as a fraction in its simplest form, the value of

- $\tan \angle BAC$,
- $\cos \angle ACD$.

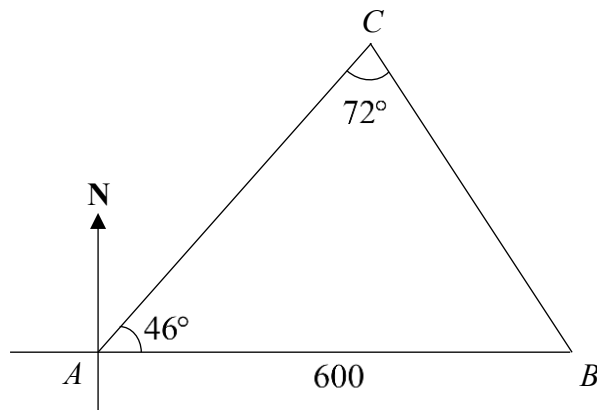
48) A ship sails from a Port A at 10 00 on a bearing of 050° towards port B . It sails at an average speed of 30 km/h, reaching Port B at 12 35. From port B , it sails to Port C which is 90 km away. The ship sets sail again to Port D , which is due north of Port B . The figure below shows the route taken by the ship.



Given also that $\angle ABC = 111^\circ$ and $\angle BCD = 25^\circ$.

- Show that the distance of $AB = 77.5$ km.
- Calculate the distance of AC .
- Calculate the distance of BD
- Find the bearing of A from C , to the nearest degree.
- The ship sent a distress signal that a crew member had fallen overboard. A search and rescue team decided to comb the area enclosed by port B , C and D . Find this area.
- A helicopter, H is hovering at a point 3 km vertically above port B . Calculate the angle of elevation of the helicopter when viewed from Port C .

49) In the diagram, points A , B and C are on level ground.



B is due east of A . $\angle ACB = 72^\circ$, $\angle BAC = 46^\circ$ and $AB = 600$ m . Calculate

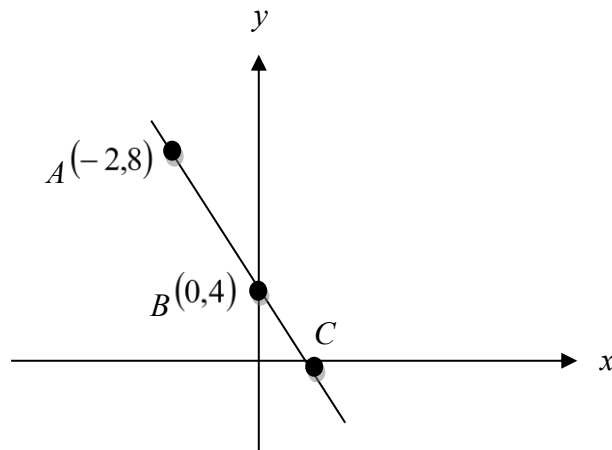
- the bearing of C from A ,
- the distance AC ,
- the shortest distance from C to AB .

CT is a vertical tower at C .

The angle of elevation of the top of the tower from A is 15° .

- Calculate the height of the tower, CT .

50) The diagram shows a straight line passing through the points $A(-2,8)$, $B(0,4)$ and C .

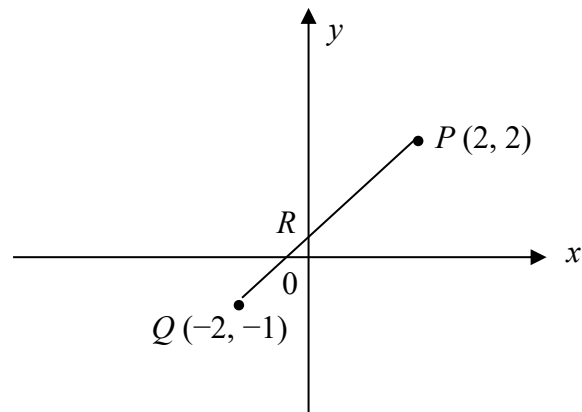


- a) Calculate the length of the line joining A to B .
- b) Find the equation of the line.
- c) Write down the coordinates of point C .

51) The line $6x - 3y = 24$ cuts the x -axis at M and y -axis at N .

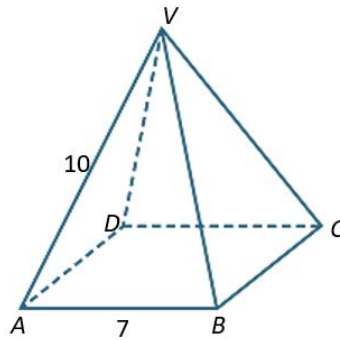
- a) Find the coordinates of M and N .
- b) Another line l has the same gradient as the given line and passes through the point $(1, 5)$. Find the equation of the line l .

52) The diagram below shows the line joining the point $P(2, 2)$ and point $Q(-2, -1)$. The line cuts the y -axis at R .



- Calculate the length of PQ .
- Find the equation of PQ .
- Find the coordinates of the point R .

53)



$ABCD$ is the square base of a pyramid. $AB = 7$ cm and $VA = VB = VC = VD = 10$ cm.

- Find angle AVB .
- Find AC .
- Find the volume of the pyramid

54) A shop sells orange pudding in bowls. The bowl can be modelled as a hemisphere of radius 4.5 cm as shown in Figure 1.

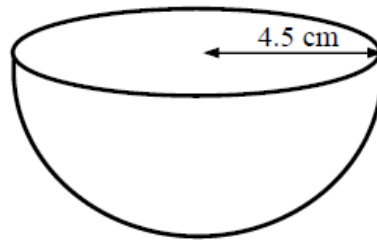
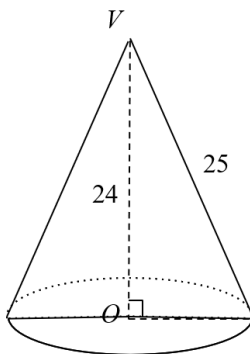


Figure 1

Calculate the volume of one bowl of orange pudding.

55) The height of a right circular cone is 24 cm and its slant height is 25 cm.



Find

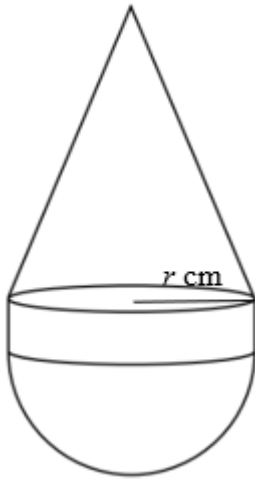
- a) the radius of the cone,
- b) the total surface area of the cone.

56) The diagram shows a paper weight which is made from a cone, a cylinder and a hemisphere.

The height of the cylinder is half of its radius.

The height of the cone is 5 times the height of the cylinder.

The cone, cylinder and hemisphere all have radius r cm.



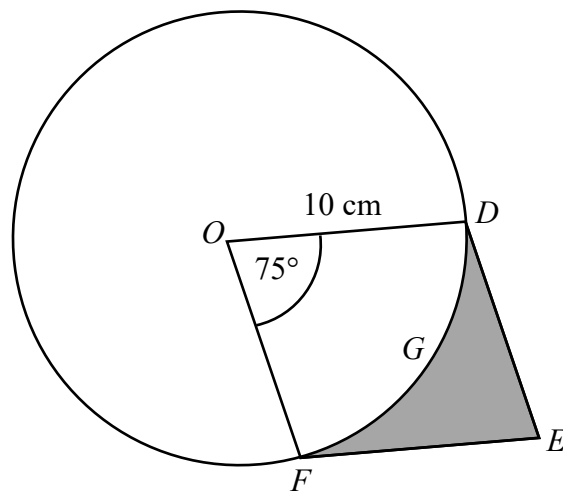
a) Express V , the volume of the paper weight in terms of r .

Hence show that $r = \sqrt[3]{\frac{V}{2\pi}}$

c) Given that the volume of the paper weight is $1.458\pi \text{ cm}^3$, find r .

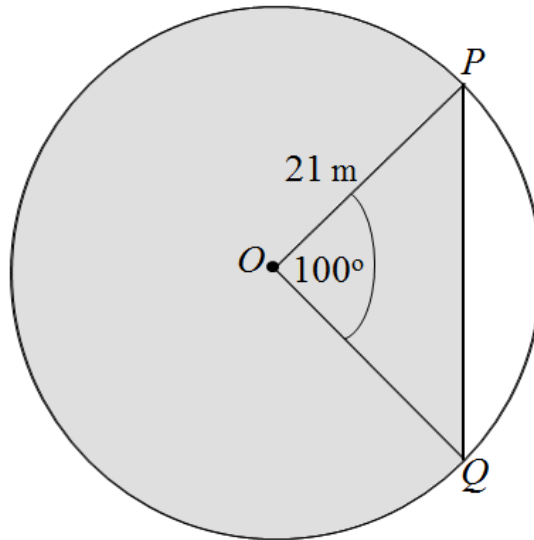
d) Calculate the total surface area of the paper weight.

57) The diagram below shows the parallelogram $ODEF$ and a circle. The circle has centre O , radius 10 cm and the angle FOD is 75° .



- Find the length of minor arc DGF
- Find the perimeter of the shaded region

58) In the diagram below, points P and Q lie on a circle with centre O .
 $OP = 21$ m and $\angle POQ = 100^\circ$. Find the area of the shaded region.



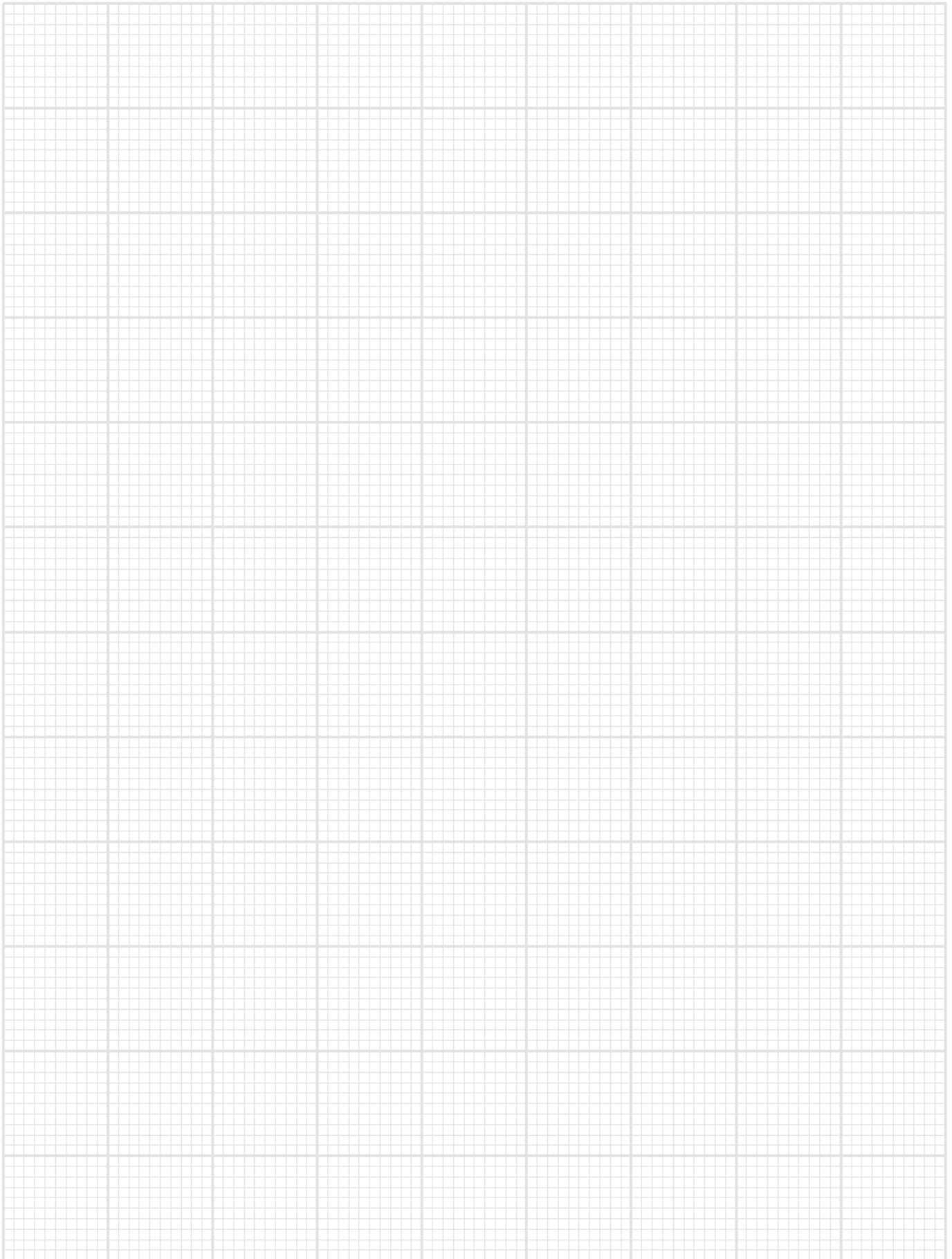
59) Answer the whole of this question on a sheet of graph paper.

The variables x and y are connected by the equation $y = \frac{x^3}{10} - \frac{x}{2}$.

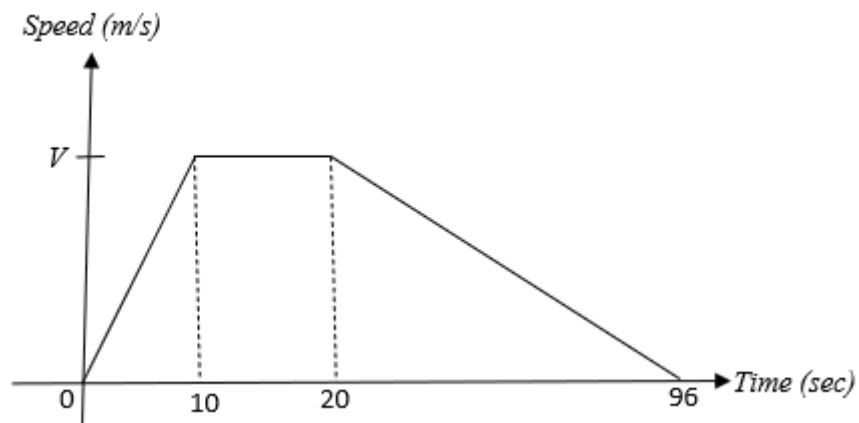
The table below shows some corresponding values of x and y .

x	0	1	2	3	4	4.5
y	0	-0.4	-0.2	1.2	p	6.9

- Calculate the value of p .
- Using a scale of 2 cm to 1 unit on each axis, draw a horizontal x -axis for $0 \leq x \leq 5$ and a vertical y -axis for $-1 \leq y \leq 7$. On your axes, plot the points given in the table and join them with a smooth curve.
- By drawing a tangent, find the gradient of the curve at the point where $x = 3$.
- Use your graph to solve the equation $\frac{x^3}{10} - \frac{x}{2} = 2$.
- What is the minimum value of the curve?
- On the same axes, draw the graph of the line $y = -x + 6$ for $0 \leq x \leq 5$.
- Write down the x coordinate of the point where the two graphs intersect.
- This value of x is a solution of the equation $x^3 + Ax + B = 0$. Find the value of A and of B .



60)



The diagram shows the speed-time graph for a bus journey between two stops. The bus travelled a distance of 848 metres.

- Calculate the greatest speed, V m/s, of the bus.
- Calculate the acceleration of the bus after 5 sec from start of the journey
- Calculate the speed of the bus when $t = 39$ sec