

Year 10 Mathematics Exam Practice

Middle School Exams 2026

Name _____ Class _____

Practise each skill, then attempt the questions that combine methods. Show working and use the supplied diagrams. Unless stated otherwise, diagrams are not drawn to scale. This is a revision booklet, not a timed examination.

Use degree mode. Give non exact lengths to 3 significant figures, angles to 1 decimal place and money to the nearest cent. Keep unrounded values until your final answer. Use π from your calculator. Constructions and scale drawings must be accurate.

For quartiles, find the median of each half. If the number of values is odd, exclude the overall median first.

Sections

1. Number Skills
2. Percentages
3. Algebra One and Sequences
4. Pythagoras and Trigonometry
5. Mensuration
6. Linear Equations and Inequalities
7. Straight Line Graphs
8. Geometry
9. Algebra Two
10. Vectors
11. Transformations
12. Statistics
13. Probability
14. Sets and Venn Diagrams
15. Graphing Functions
16. Supplementary Proportionality
17. Supplementary Travel and Conversion Graphs
18. Supplementary Extension Algebra

The last three sections are supplementary topics scheduled after the Middle School Exams. Complete the main sections first.

Useful mensuration formulae

Circle: $A = \pi r^2$, $C = 2\pi r$. Prism: $V = \text{cross sectional area} \times \text{length}$. Cylinder: $V = \pi r^2 h$, curved area = $2\pi r h$. Cone: $V = \frac{\pi r^2 h}{3}$. Pyramid: $V = \text{base area} \times \frac{h}{3}$. Sphere: $V = \frac{4\pi r^3}{3}$, surface area = $4\pi r^2$.

Number Skills

Question 1

Calculate. Show the order of operations.

(a) $-14 + 6 \times (-3) - (-8)$

(b) $7.35 - 2.8 \times 1.5$

(c) $(5.6 + 2.4) \div 0.32$

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Question 2

(a) Convert $\frac{29}{6}$ to a mixed number and $3\frac{5}{8}$ to an improper fraction.

(b) Calculate $2\frac{1}{3} + 1\frac{5}{6}$.

(c) Calculate $4\frac{1}{5} - 2\frac{3}{4}$.

(d) Calculate $1\frac{3}{5} \times 2\frac{1}{4}$.

(e) Calculate $3\frac{1}{2} \div 1\frac{1}{6}$.

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Question 3

A camp has 84 students. Three sevenths choose kayaking. Each kayaking group holds 6 students. Each group needs $2\frac{1}{2}$ litres of drinking water.

(a) How many students choose kayaking?

(b) How many groups are needed?

(c) How much water is needed altogether?

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Number Skills Continued

Question 4

- (a) Simplify $1.2 : 0.45$.
- (b) Complete $7 : 9 = 35 : \underline{\hspace{2cm}}$.
- (c) Share \$936 in the ratio 5 : 8.
- (d) A drink uses syrup and water in the ratio 2 : 7. How much syrup is needed for 2.7 litres of drink?

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Question 5

- (a) A printer produces 252 pages in 3.5 minutes. Find its rate in pages per minute.
- (b) A van travels 156 km using 12 litres of fuel. Find the rate in km per litre.
- (c) At this rate, fuel costs \$2.65 per litre. Find the fuel cost of a 390 km trip.

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Question 6

- (a) Write 0.0000724 in standard form.
- (b) Write 6.08×10^5 in ordinary form.
- (c) Calculate $(3.6 \times 10^7)(2.5 \times 10^{-3})$, in standard form.
- (d) A server stores 7.2×10^{11} bytes. Each file uses 4.8×10^6 bytes. How many complete files fit?
- (e) Write 360 as a product of prime factors.

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Percentages

Question 7

- (a) Write $\frac{7}{16}$ and 0.082 as percentages.
- (b) Find 18% of 650.
- (c) A team wins 27 of its 36 matches. Express its wins as a percentage of its matches.

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Question 8

A retailer buys a backpack for \$64 and marks it up by 35%.

- (a) Find the selling price before *GST*.
- (b) Add 15% *GST*.
- (c) The *GST* inclusive price is then discounted by 20%. Find the final price.
- (d) Explain why a 20% increase followed by a 20% decrease does not restore an original price.

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Question 9

- (a) A bicycle costs \$357 after a 15% discount. Find its original price.
- (b) An invoice totals \$529 including 15% *GST*. Find the price before *GST* and the *GST* amount.

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Percentages Continued

Question 10

A student deposits \$1250 for 4 years.

- (a) Find the interest and total balance at 4.2% per year simple interest.
- (b) Find the balance at 4% per year compound interest, compounded annually.
- (c) Which option gives the larger balance and by how much?

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Question 11

A school orders 48 calculators at a listed price of \$32 each, excluding *GST*. The supplier gives a 12.5% discount, adds 15% *GST*, then adds a fixed *GST* inclusive delivery charge of \$18.

- (a) Find the total invoice.
- (b) Students pay \$34 each. Find the total surplus or shortfall after all 48 calculators are sold.

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Algebra One and Sequences

Question 12

- (a) Explain why $x^3 \times x^4 = x^7$ by writing out the factors.
- (b) Simplify $a^9 \div a^4$, where $a \neq 0$. Explain your cancellation.
- (c) Explain and simplify $(b^2)^3$.
- (d) Simplify $24p^7q^4 \div 8p^3q^2$ and $(2r^3s^2)^3$.

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Question 13

- (a) Simplify $8a - 3b + 5a + 9b - 4$.
- (b) Expand and simplify $3x(2x - 5) - x(x + 4)$.
- (c) Find $2u^2 - 3uv + v^2$ when $u = -3$ and $v = 2$.
- (d) Use $C = \left(\frac{5}{9}\right)(F - 32)$ to find C when $F = 77$.

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Question 14

A row of adjoining squares is made from matchsticks. One square uses 4 sticks; two use 7; three use 10.

- (a) Draw the arrangement for four squares.
- (b) Find and justify the rule for n squares.
- (c) Find the number of sticks for 28 squares.
- (d) Can an arrangement use exactly 100 sticks? Explain.

Algebra One and Sequences Continued

Question 15

For each sequence, give the next two terms and a formula for the n th term, starting with $n = 1$.

(a) 3, 6, 11, 18, 27, ...

(b) 2, 9, 28, 65, 126, ...

(c) 14, 20, 26, 32, ...

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Algebra One and Sequences Continued

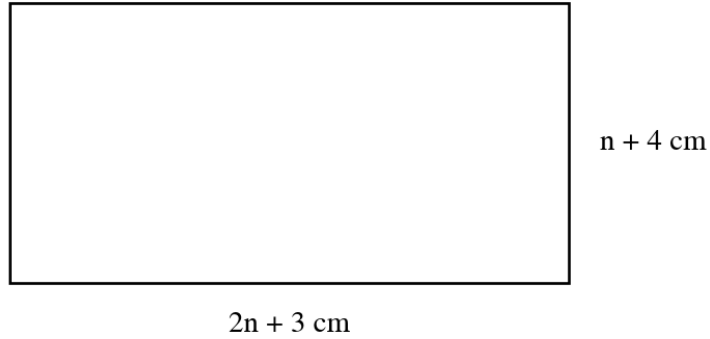
Question 16

A rectangular display board is $(2n + 3)$ cm long and $(n + 4)$ cm wide.

(a) Write and simplify a formula for its perimeter.

(b) Find the perimeter when $n = 6$.

(c) Find and simplify its area formula. Is the area sequence linear or quadratic?



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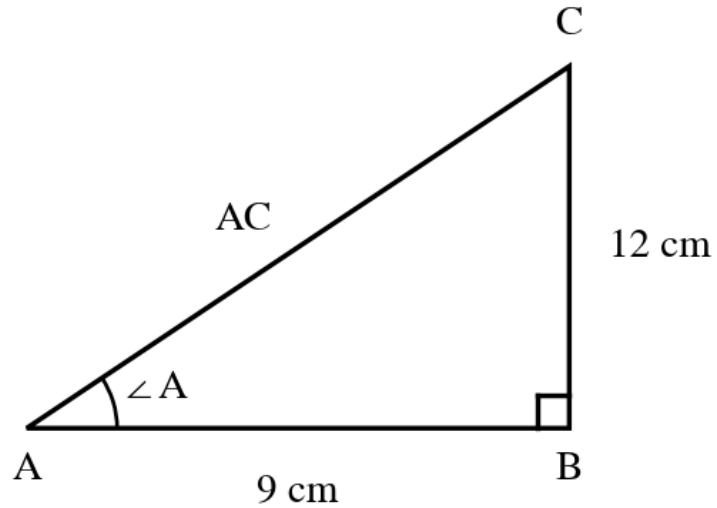
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Pythagoras and Trigonometry

Question 17

Triangle ABC is right angled at B . $AB = 9$ cm and $BC = 12$ cm.

- (a) Use the diagram to label the sides. Relative to angle A , label the opposite, adjacent and hypotenuse.
- (b) Find AC using Pythagoras.
- (c) Choose a ratio and find angle A to 1 decimal place.



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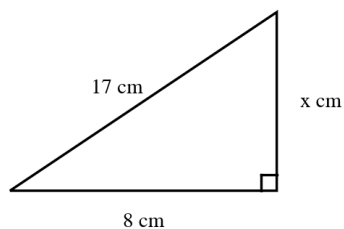
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Pythagoras and Trigonometry Continued

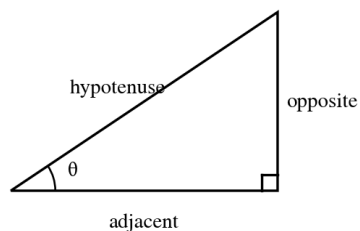
Question 18

- (a) In a right triangle, the hypotenuse is 17 cm and one shorter side is 8 cm. Find the other side.
(b) Calculate $\sin 37^\circ$, $\cos 62^\circ$ and $\tan 24^\circ$ to 3 decimal places.
(c) Find the acute angle θ if $\sin \theta = 0.428$, to 1 decimal place.

(a)



(c) $\sin \theta = 0.428$



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Pythagoras and Trigonometry Continued

Question 19

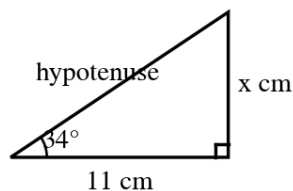
For each right triangle shown, choose a ratio and find the requested side to 3 significant figures.

(a) An angle is 34° and its adjacent side is 11 cm. Find the opposite side.

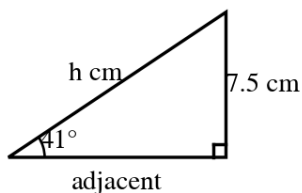
(b) An angle is 41° and its opposite side is 7.5 cm. Find the hypotenuse.

(c) An angle is 28° and the hypotenuse is 19 cm. Find the adjacent side.

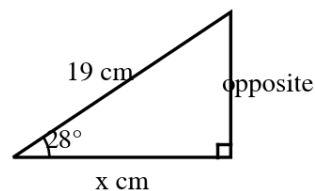
(a)



(b)



(c)



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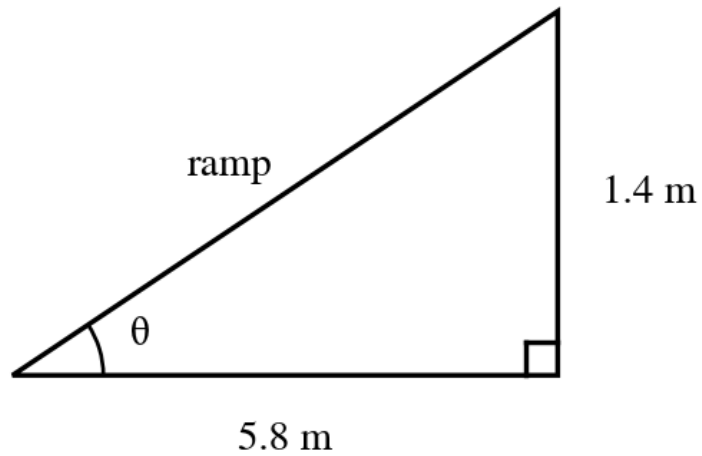
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Pythagoras and Trigonometry Continued

Question 20

A straight ramp rises 1.4 m over a horizontal distance of 5.8 m.

- (a) Find the ramp length.
- (b) Find its angle to the horizontal.
- (c) A safety rule requires an angle no greater than 12° . Does it meet this rule? Give unrounded evidence.



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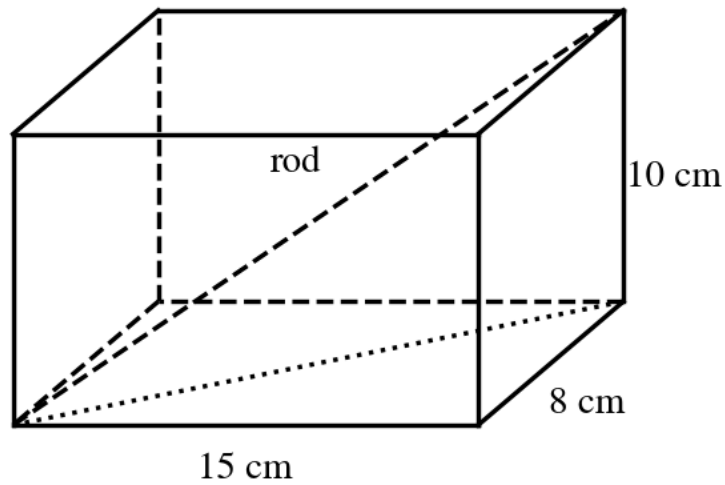
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Pythagoras and Trigonometry Continued

Question 21

A cuboid has length 15 cm, width 8 cm and vertical height 10 cm. A rod joins one bottom corner to the diagonally opposite top corner.

- (a) Find the diagonal of the base.
- (b) Find the rod length.
- (c) Find the angle between the rod and the horizontal base.



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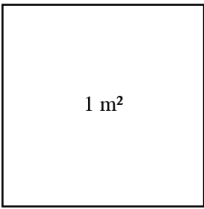
Mensuration

Question 22

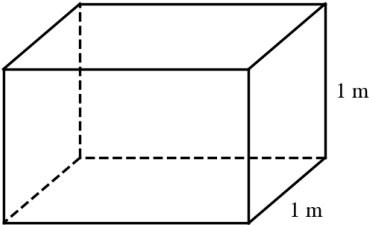
Convert.

- (a) 3.75 km to metres; 680 mm to centimetres.
- (b) 2.4 m^2 to cm^2 ; 85000 mm^2 to cm^2 .
- (c) 0.032 m^3 to cm^3 ; 4500 cm^3 to litres.
- (d) A length is 8.6 cm correct to the nearest 0.1 cm. State its lower and upper bounds using an inequality.

Volume conversion



$1\text{ m} = 100\text{ cm}$



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Mensuration Continued

Question 23

Calculate each area. State units.

(a) Rectangle 13 cm by 7 cm.

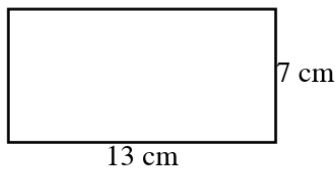
(b) Triangle with base 14 cm and perpendicular height 9 cm.

(c) Parallelogram with base 11 cm and perpendicular height 6 cm.

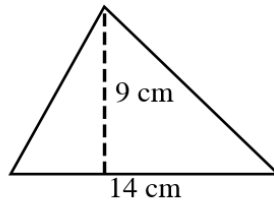
(d) Trapezium with parallel sides 9 cm and 17 cm and perpendicular height 5 cm.

(e) An *L* shaped floor is a 9 m by 7 m rectangle with a 3 m by 2 m rectangle removed from a corner. Find its area and perimeter.

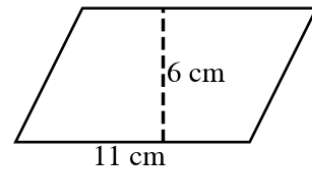
(a)



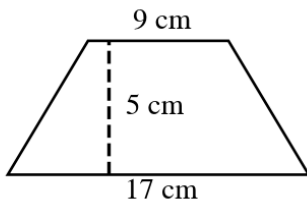
(b)



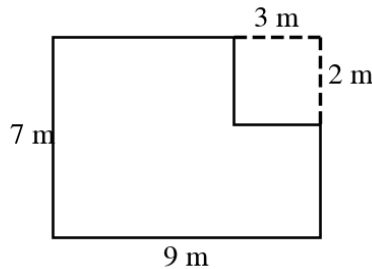
(c)



(d)



(e)



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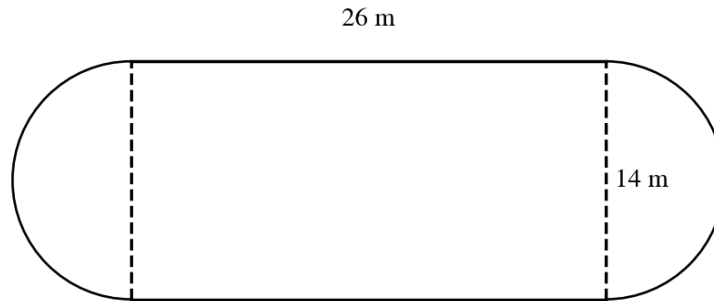
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Mensuration Continued

Question 24

A running track consists of a rectangle 26 m long and 14 m wide, with a semicircle attached to each 14 m end. The semicircles face outwards.

- (a) Use the diagram to find the perimeter.
- (b) Find the enclosed area.
- (c) A bag of fertiliser covers 85 m^2 . Find the minimum whole number of bags needed.



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Mensuration Continued

Question 25

Find the surface area.

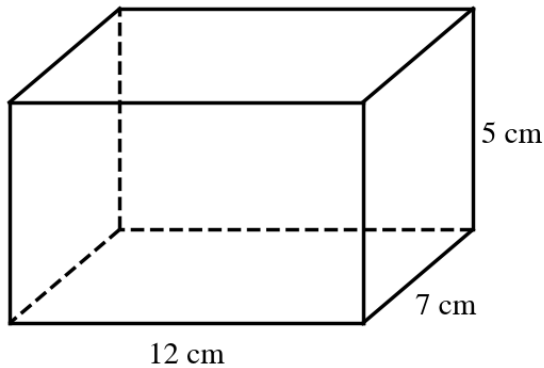
(a) A closed cuboid 12 cm by 7 cm by 5 cm.

(b) A closed cylinder of radius 4 cm and height 9 cm.

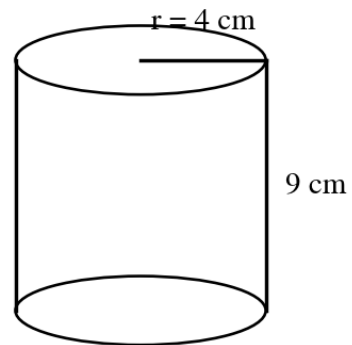
(c) A sphere of radius 6 cm.

(d) An open topped cylindrical bucket has radius 15 cm and height 28 cm. Find the area of metal required, ignoring joins.

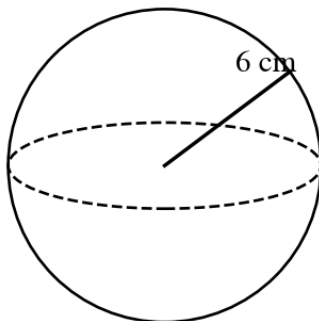
(a) Closed cuboid



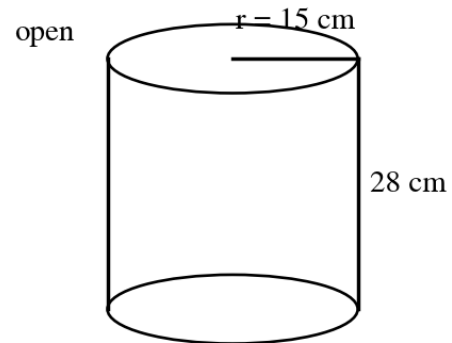
(b) Closed cylinder



(c) Sphere



(d) Bucket



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Mensuration Continued

Question 26

Find each volume. Give exact answers involving π where appropriate.

(a) A cuboid 8 cm by 6 cm by 11 cm.

(b) A triangular prism with triangular cross section base 7 cm, perpendicular height 4 cm, and prism length 18 cm.

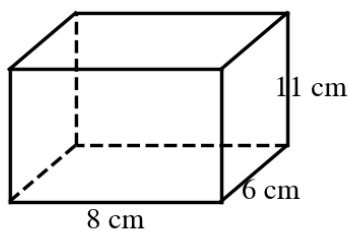
(c) A cylinder of radius 3 cm and height 14 cm.

(d) A cone of radius 5 cm and perpendicular height 12 cm.

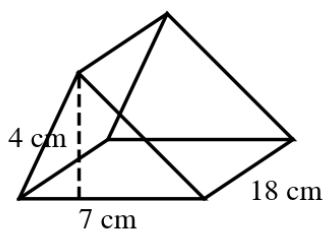
(e) A pyramid with rectangular base 9 cm by 8 cm and perpendicular height 10 cm.

(f) A sphere of radius 3 cm.

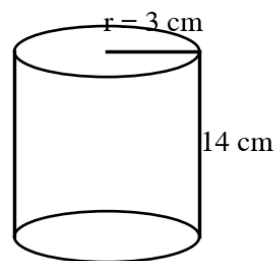
(a) Cuboid



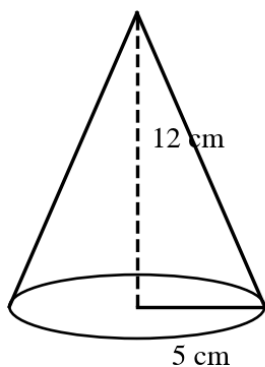
(b) Triangular prism



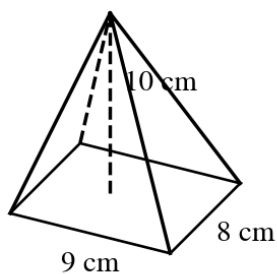
(c) Cylinder



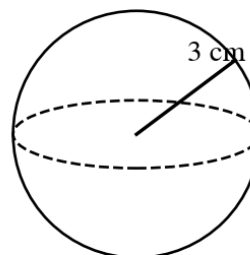
(d) Cone



(e) Pyramid



(f) Sphere



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Mensuration Continued

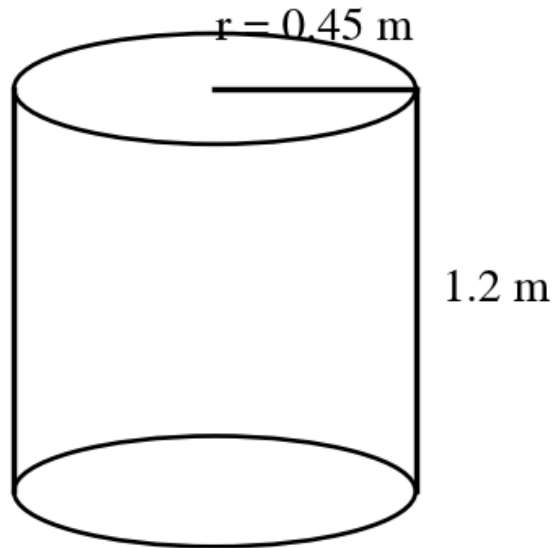
Question 27

A tank is modelled as a cylinder of internal radius 0.45 m and internal height 1.2 m.

(a) Find its full capacity in litres.

(b) It is 80% full. Water is pumped out at 18 litres per minute. Find the time to empty it.

(c) The radius was measured as 45 cm to the nearest centimetre. If the height is exactly 120 cm, find the lower and upper bounds of its full capacity in litres.



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Linear Equations and Inequalities

Question 28

Solve. Show each algebraic step.

(a) $4(3x - 2) = 5x + 27$.

(b) $\frac{2y-1}{5} + \frac{y}{2} = 7$.

(c) $5 - 2t \leq 17$. Draw the solution on a number line.

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Question 29

Rearrange.

(a) $V = IR$ to make R the subject.

(b) $y = \frac{5x+7}{3}$ to make x the subject.

(c) $A = \frac{bh}{2}$ to make h the subject.

(d) $z = \sqrt{3w + 4}$ to make w the subject.

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Question 30

Solve simultaneously.

(a) $3x + y = 19$ and $2x - 3y = -2$.

(b) $4a + 3b = 29$ and $2a - b = 7$.

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Linear Equations and Inequalities Continued

Question 31

A hire company charges a fixed booking fee of \$24 plus \$9 per hour.

- (a) Write and justify a formula for the cost C for h hours.
- (b) A customer has at most \$87. Form and solve an inequality for h .
- (c) If only whole hours can be booked, what is the maximum booking?

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Question 32

At a school show, adult tickets cost \$14 and student tickets cost \$9. A total of 73 tickets brings in \$817.

- (a) Define variables and form two simultaneous equations.
- (b) Find how many of each type were sold.
- (c) Check both the total number and the total income.

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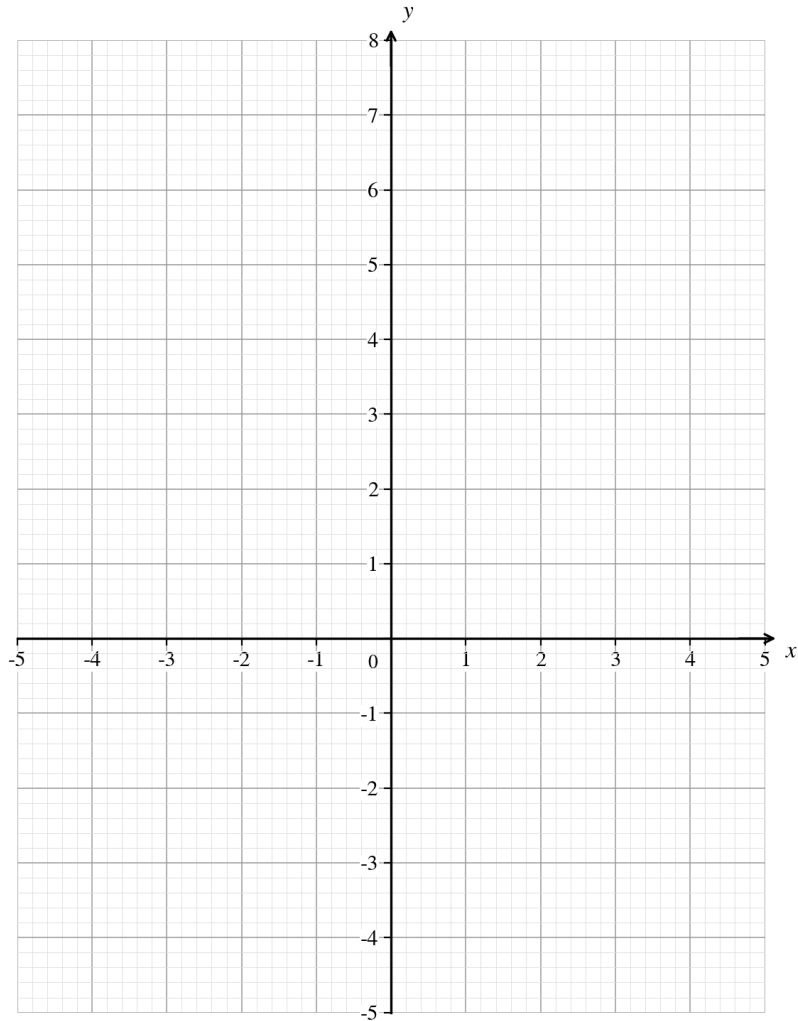
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Straight Line Graphs

Question 33

- (a) Plot $A(-3, 2)$, $B(1, -2)$ and $C(4, 1)$ on the grid.
- (b) Complete a table for $y = -2x + 3$ using $x = -2, -1, 0, 1, 2, 3$. Draw the line.
- (c) State its gradient and y intercept.
- (d) Draw a parallel line through $(0, -3)$ and give its equation.



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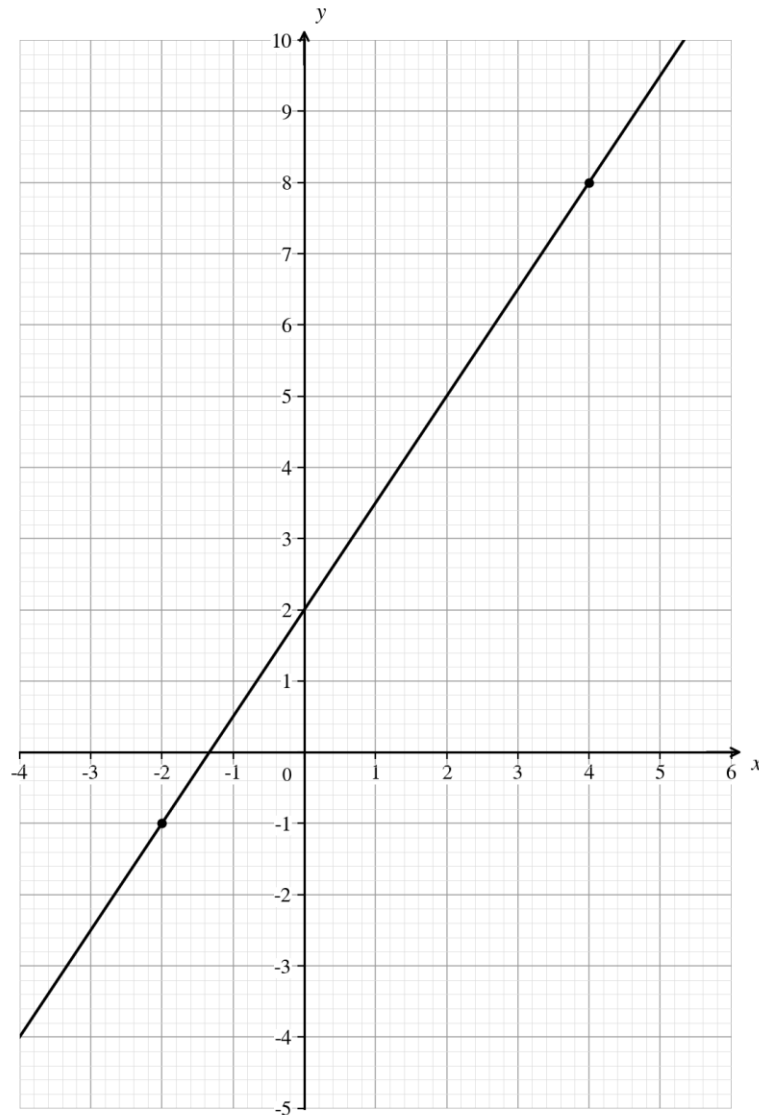
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Straight Line Graphs Continued

Question 34

The line shown passes through $(-2, -1)$ and $(4, 8)$.

- (a) Read its y intercept from the graph.
- (b) Calculate its gradient and write its equation.
- (c) Find the equation of the parallel line through $(2, -4)$.
- (d) Does $(10, 17)$ lie on the original line? Justify.

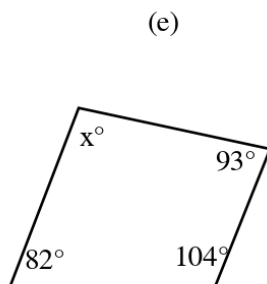
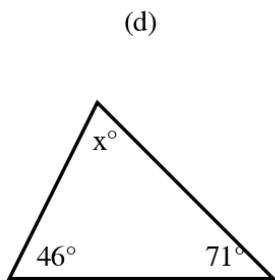
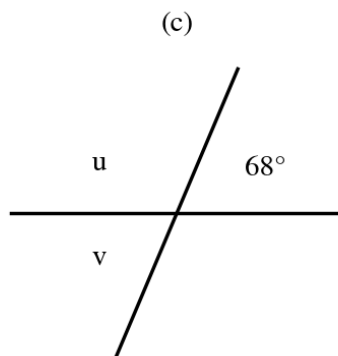
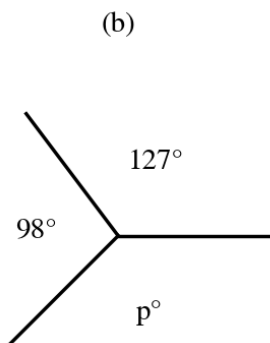
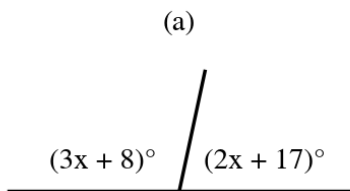


Geometry

Question 35

Find each angle and state the angle property used.

- Two adjacent angles on a straight line are $(3x + 8)^\circ$ and $(2x + 17)^\circ$. Find x and both angles.
- Three angles around a point are 127° , 98° and p° . Find p .
- Two straight lines intersect. One angle is 68° . Find the vertically opposite angle and an adjacent angle.
- A triangle has angles 46° and 71° . Find its third angle.
- A quadrilateral has angles 82° , 104° and 93° . Find its fourth angle.



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Geometry Continued

Question 36

Two parallel lines are cut by a transversal. One angle is 73° .

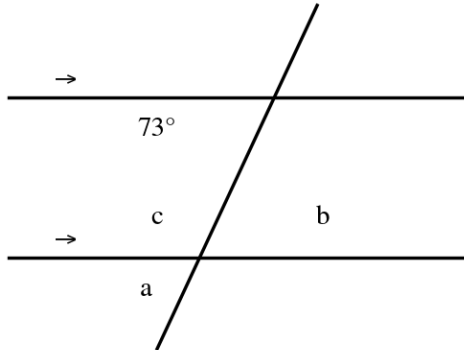
(a) Find its corresponding angle.

(b) Find its alternate interior angle.

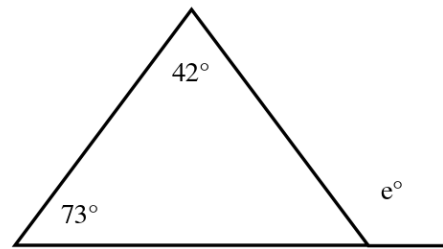
(c) Find its co interior angle on the same side of the transversal.

(d) A triangle has one angle of 73° and another of 42° . Find the exterior angle at the third vertex. Give a reason for each step.

(a) Corresponding a (b) Alternate b (c) Co interior c



(d)



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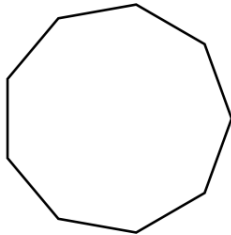
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Geometry Continued

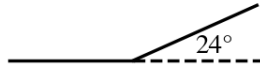
Question 37

- (a) Find the sum of the interior angles of a nonagon.
- (b) A regular polygon has exterior angle 24° . Find the number of sides and each interior angle.
- (c) Five interior angles of a hexagon are 110° , 124° , 98° , 143° and 119° . Find the sixth angle.

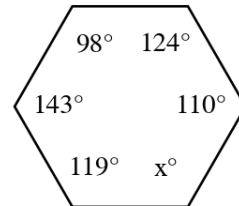
(a) Nonagon



(b) Part of a regular polygon



(c) Hexagon



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Geometry Continued

Question 38

In each case, all named points except the centre lie on the circle. Give reasons.

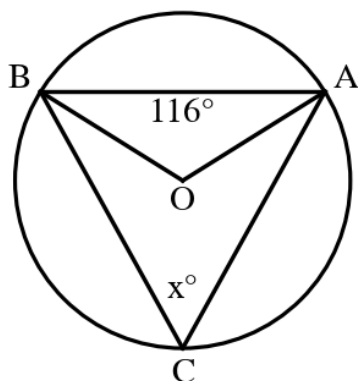
(a) O is the centre. A and B are endpoints of a chord. C lies on the major arc AB and $\angle AOB = 116^\circ$ (the minor central angle). Find $\angle ACB$.

(b) A, B, C, D occur in that order around a circle. $\angle ADB = 39^\circ$. Find $\angle ACB$.

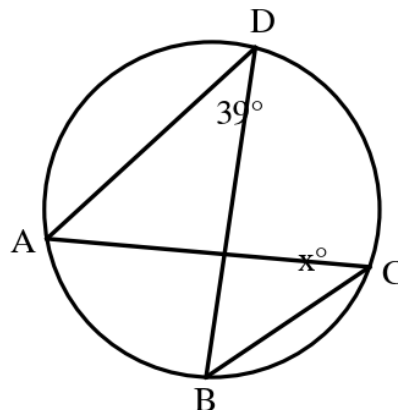
(c) AB is a diameter and C is another point on the circle. Find $\angle ACB$.

(d) $PQRS$ is cyclic, with $\angle P = 112^\circ$ and $\angle Q = 87^\circ$. Find $\angle R$ and $\angle S$.

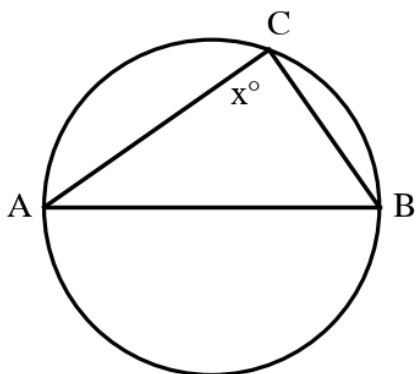
(a)



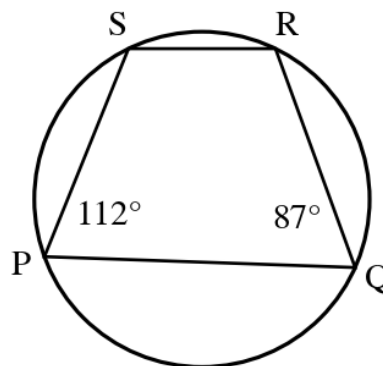
(b)



(c)



(d)



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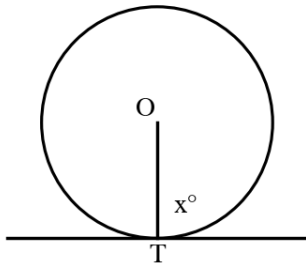
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Geometry Continued

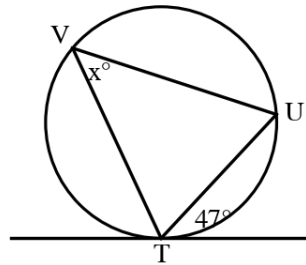
Question 39

- (a) A tangent touches a circle at T . Find the angle between OT and the tangent, where O is the centre.
- (b) A chord TU makes an acute angle of 47° with the tangent at T . V lies on the circumference in the opposite segment to this acute angle. Find $\angle TVU$ and name the theorem.
- (c) A circle has radius 13 cm. Its centre is 5 cm from chord AB . Find AB , using the perpendicular chord theorem and Pythagoras.

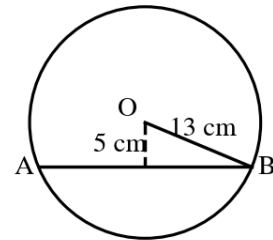
(a)



(b)



(c)



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Geometry Continued

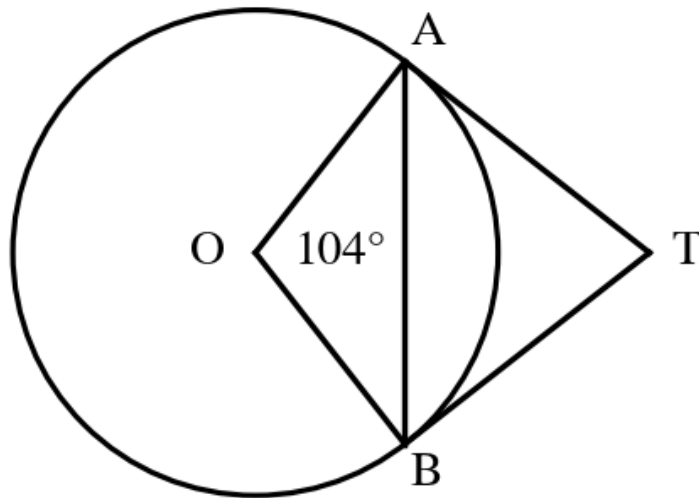
Question 40

A and B lie on a circle with centre O . $\angle AOB = 104^\circ$. Tangents at A and B meet at T .

(a) Find $\angle OAT$ and $\angle OBT$.

(b) Hence find $\angle ATB$.

(c) Find each base angle of triangle AOB and explain why they are equal.



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Geometry Continued

Question 41

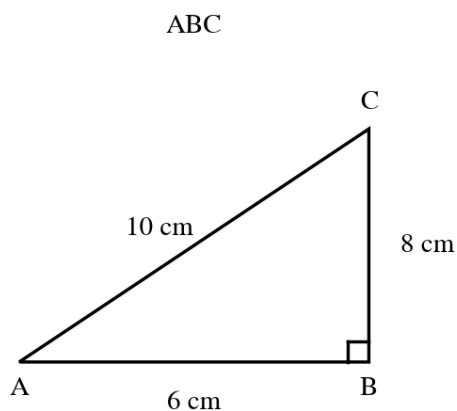
Triangles ABC and DEF are similar, with $A \leftrightarrow D, B \leftrightarrow E, C \leftrightarrow F$. $AB = 6$ cm, $BC = 8$ cm, $AC = 10$ cm and $DE = 9$ cm.

(a) Find the length scale factor from ABC to DEF .

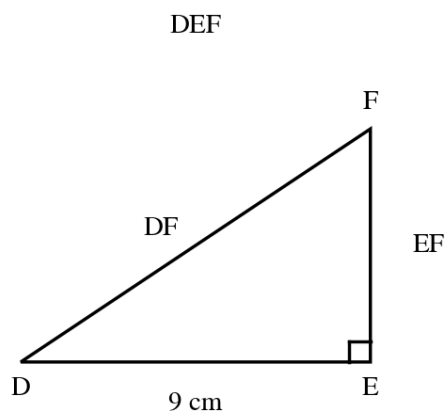
(b) Find EF and DF .

(c) If ABC has area 24 cm^2 , find the area of DEF .

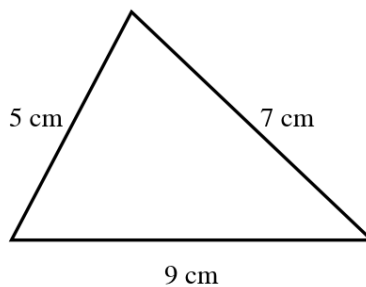
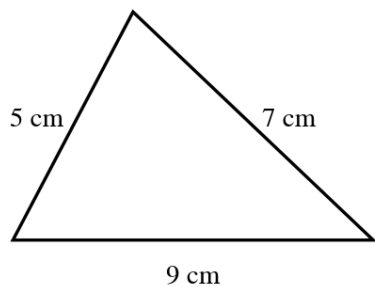
(d) Two other triangles have side lengths 5 cm, 7 cm, 9 cm and 9 cm, 5 cm, 7 cm. Explain whether they are congruent.



Triangle 1



Triangle 2



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Geometry Continued

Question 42

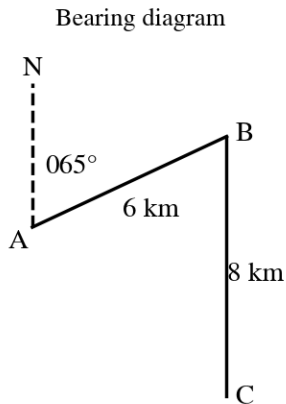
Town B is 6 km from town A on a bearing of 065° .

(a) Find the bearing of A from B .

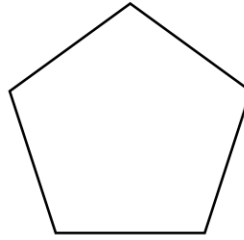
(b) Use a scale of 1 cm to 2 km to draw AB with a north line at A .

(c) Town C is 8 km due south of B . Add C to the drawing and estimate AC .

(d) State the number of lines of symmetry and order of rotational symmetry of a regular pentagon and a non square rectangle.



Regular pentagon



Non square rectangle



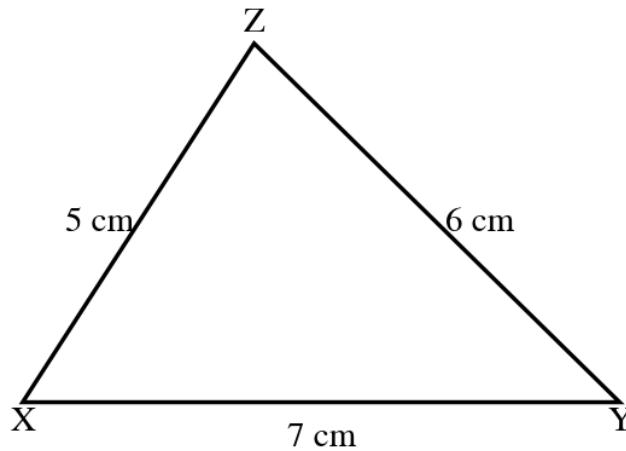
Geometry Continued

Question 43

Use a ruler and compass, leaving construction arcs visible.

- (a) Construct triangle XYZ with $XY = 7$ cm, $XZ = 5$ cm and $YZ = 6$ cm.
- (b) Construct the perpendicular bisector of XY .
- (c) Mark its intersection with XY as M and state XM .
- (d) Explain why any point on this perpendicular bisector is equally distant from X and Y .

Reference sketch only construct your own triangle below



Algebra Two

Question 44

Expand and simplify.

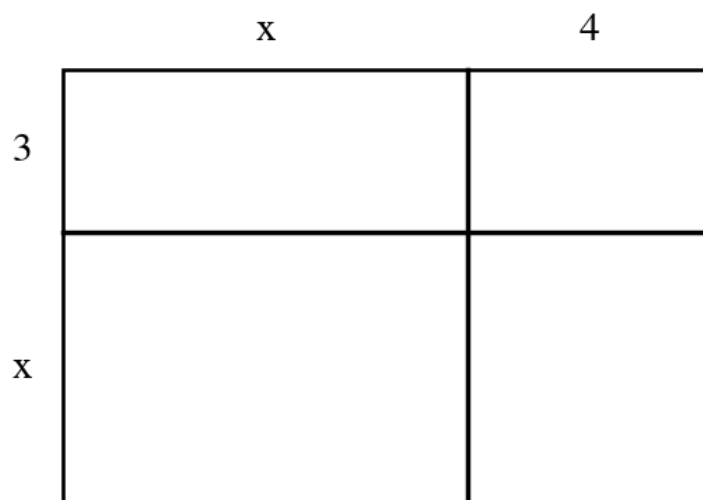
(a) $-4(2x - 7)$.

(b) $(x + 6)(x - 2)$.

(c) $(3t - 2)(2t + 5)$.

(d) Draw a rectangle area model to explain the four terms in $(x + 4)(x + 3)$.

(d) Area model



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Algebra Two Continued

Question 45

Factorise completely.

(a) $15a^3b - 20a^2b^2$.

(b) $49m^2 - 16$.

(c) $x^2 + 3x - 40$.

(d) $2y^2 + 7y + 3$.

(e) $3z^3 - 27z$.

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Question 46

Simplify, stating excluded values.

(a) $\frac{12x^2y}{18xy^2}$.

(b) $\frac{t^2 - 25}{t^2 + 2t - 15}$.

(c) $\frac{2k+1}{6} + \frac{k-4}{3}$.

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Algebra Two Continued

Question 47

Solve.

(a) $x^2 + 2x - 35 = 0$.

(b) $3u^2 = 75$.

(c) $2v^2 - 5v - 3 = 0$.

(d) $w(w - 6) = 16$.

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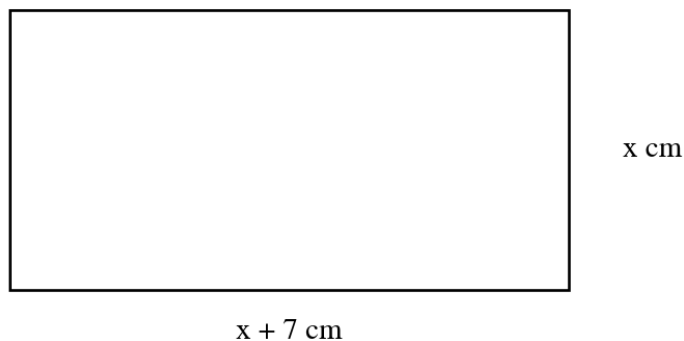
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Algebra Two Continued

Question 48

A rectangular sign has width x cm and length $(x + 7)$ cm. Its area is 120 cm^2 .

- (a) Form a quadratic equation.
- (b) Solve it and explain why one solution must be rejected.
- (c) Find the perimeter of the sign.
- (d) A border strip costs \$0.08 per centimetre. Find the cost of edging the sign.



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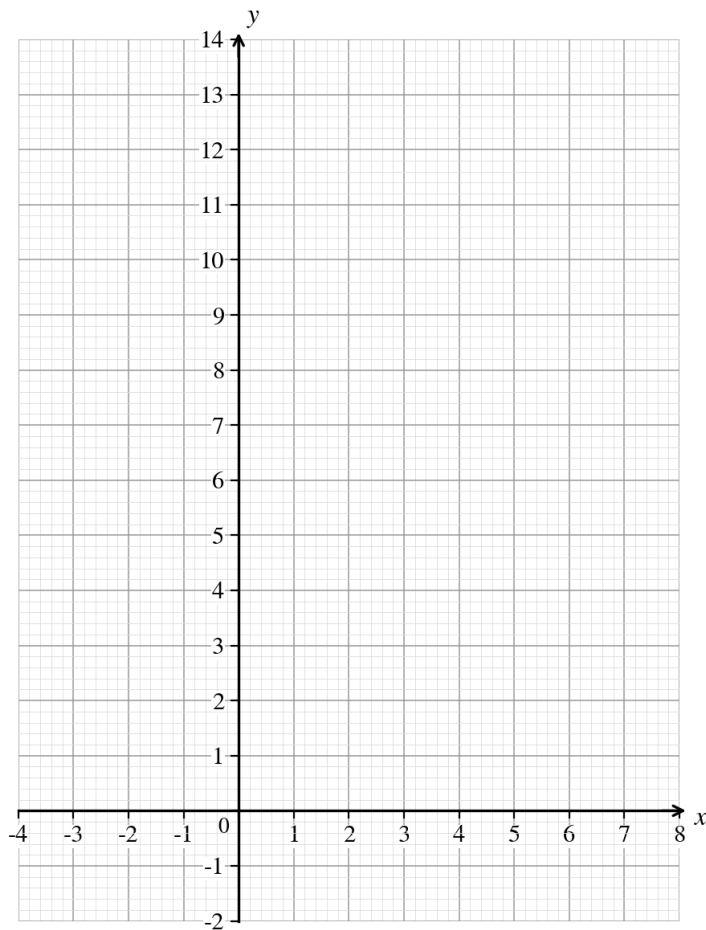
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Vectors

Question 49

Let a have column components 6 and 8, and b have column components -3 and 5.

- (a) Write a and b as column vectors and explain what each component of a means.
- (b) Find $3a$, $a + b$, $a - b$ and $2a - 3b$, in column form.
- (c) Find the magnitude of a and its direction measured anticlockwise from the positive x axis.
- (d) Draw a , b and $a + b$ using a head to tail diagram on the grid.



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Vectors Continued

Question 50

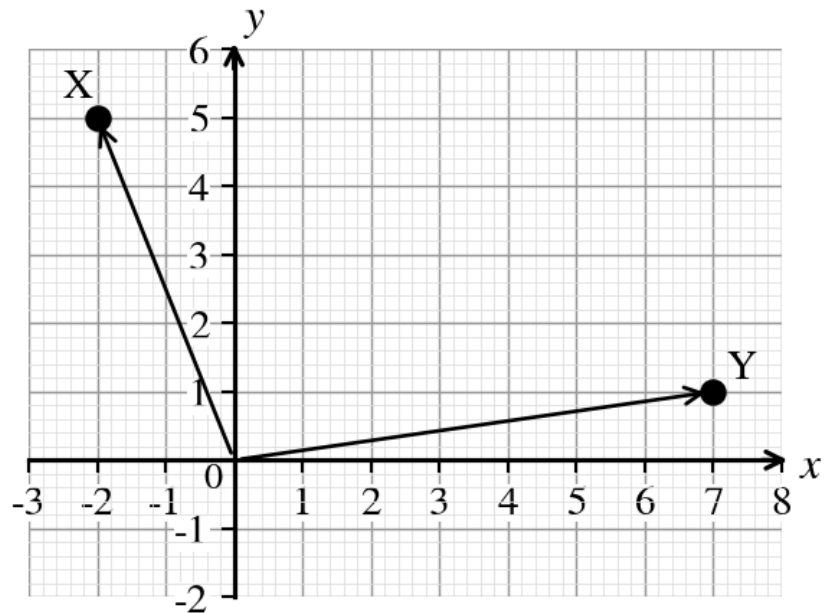
O is the origin, $X = (-2, 5)$ and $Y = (7, 1)$.

(a) Find OX, OY, XO and XY as column vectors.

(b) Draw a subtraction diagram showing $XY = OY - OX$.

(c) Find the length XY .

(d) Find k if $OX + kOY$ has first component 19; then find its second component.



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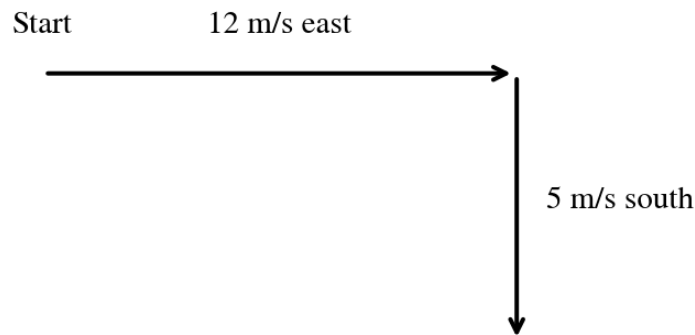
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Vectors Continued

Question 51

A drone moves through still air at $12 \frac{\text{m}}{\text{s}}$ due east. A wind adds a velocity of $5 \frac{\text{m}}{\text{s}}$ due south.

- (a) Write both velocities and the resultant as column vectors, taking east as positive x and north as positive y .
- (b) Find the resultant ground speed.
- (c) Find its bearing.
- (d) Find its displacement after 40 seconds.



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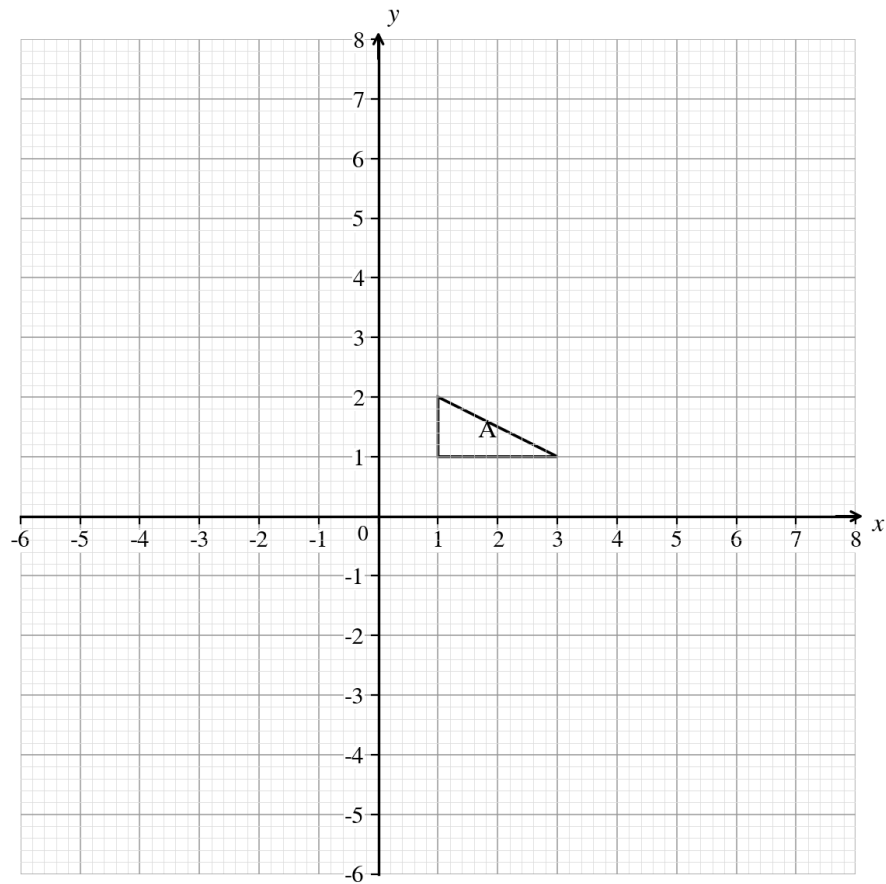
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Transformations

Question 52

Triangle A has vertices $(1, 1)$, $(3, 1)$ and $(1, 2)$. Draw A on the grid. Starting from A each time:

- (a) Translate by the column vector with components -4 and 3 ; label B .
- (b) Reflect in $x = -1$; label C .
- (c) Rotate 90° anticlockwise about $(0, 0)$; label D .
- (d) Rotate 180° about $(1, -1)$; label E . Write all image coordinates.



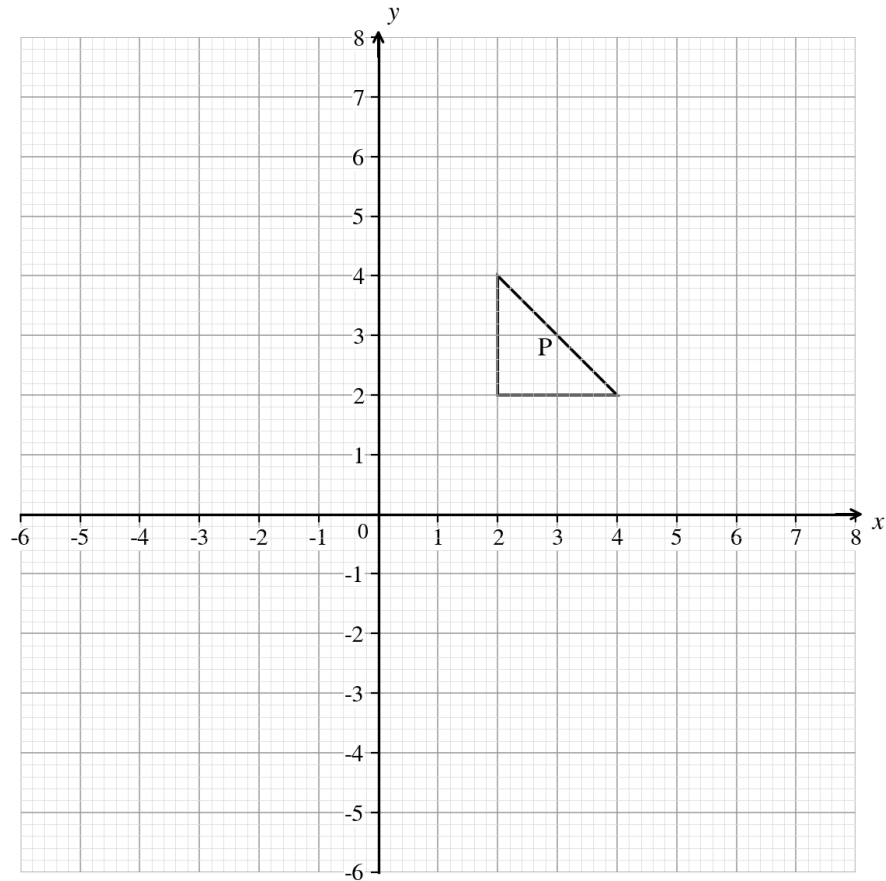
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Transformations Continued

Question 53

Triangle P has vertices $(2, 2)$, $(4, 2)$, $(2, 4)$. Starting from P each time, draw and label:

- (a) Q : enlargement, centre $(0, 0)$, scale factor $\frac{1}{2}$.
- (b) R : enlargement, centre $(0, 0)$, scale factor -1 .
- (c) S : enlargement, centre $(1, 1)$, scale factor 2.
- (d) Describe fully the enlargement that maps P onto Q . Explain how you locate its centre.



Transformations Continued

Question 54

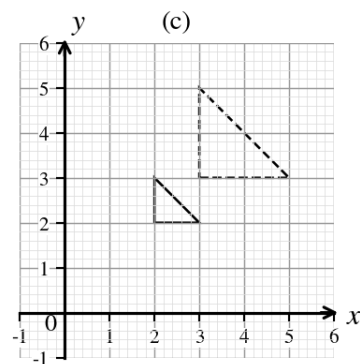
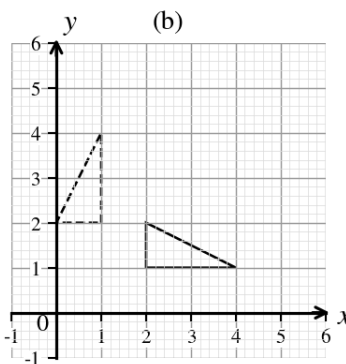
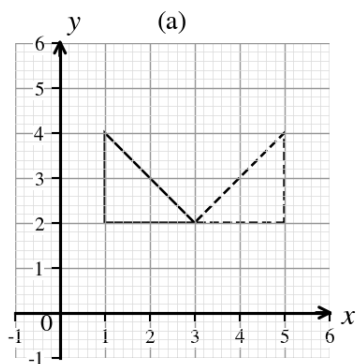
Describe each transformation fully. Corresponding vertices are listed in the same order.

(a) $(1, 2), (3, 2), (1, 4)$ map to $(5, 2), (3, 2), (5, 4)$.

(b) $(2, 1), (4, 1), (2, 2)$ map to $(1, 2), (1, 4), (0, 2)$.

(c) $(2, 2), (3, 2), (2, 3)$ map to $(3, 3), (5, 3), (3, 5)$. Show how you find the centre.

Solid outline original dashed outline image



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Transformations Continued

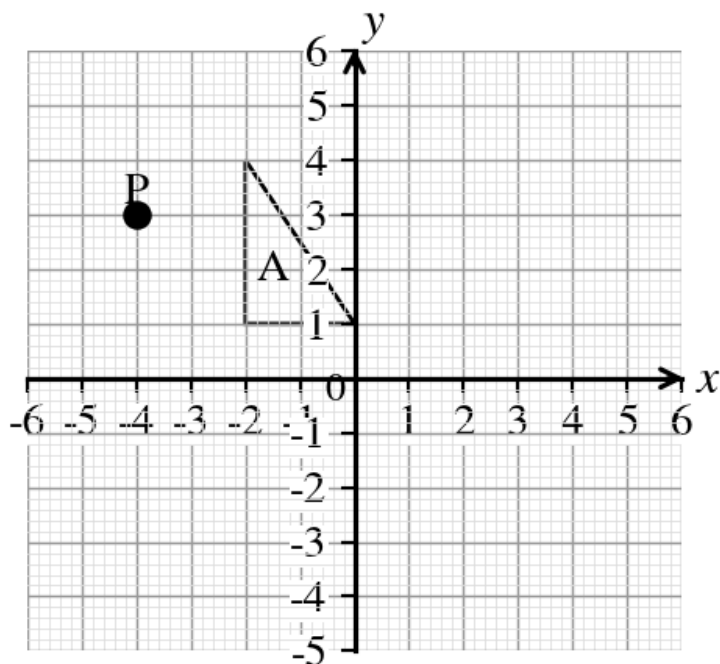
Question 55

A point is reflected in the y axis, then reflected in the x axis.

(a) Find the final image of $(-4, 3)$.

(b) Describe the single transformation with the same net effect.

(c) Triangle vertices $(-2, 1)$, $(0, 1)$, $(-2, 4)$ are translated by $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$, then by $\begin{pmatrix} -1 \\ 5 \end{pmatrix}$. Find the net translation and all final coordinates.



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Statistics

Question 56

- A school wants to estimate how long Year 10 students spend travelling to school.
- (a) Explain why surveying only students in the car park could be biased.
 - (b) Describe a simple random sample of 30 from a numbered list of all Year 10 students.
 - (c) Explain how a stratified sample could represent three equally sized Year 10 classes.
 - (d) Describe systematic sampling and one possible problem.
 - (e) Write a neutral survey question and explain why repeated or leading responses should be avoided.
 - (f) Collect and record travel times from five classmates. Explain why this sample may not represent the whole year group.

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Question 57

- These numbers record pets in 20 households:
- 0, 1, 2, 1, 3, 0, 2, 1, 4, 2, 1, 0, 2, 3, 1, 2, 0, 1, 2, 1.
- (a) Make a tally and frequency table.
 - (b) Find the mode, median, mean and range.
 - (c) Explain why a bar chart is appropriate for these data.

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Statistics Continued

Question 58

A survey of 40 students records preferred lunch: sandwiches 16, noodles 12, salad 8, other 4.

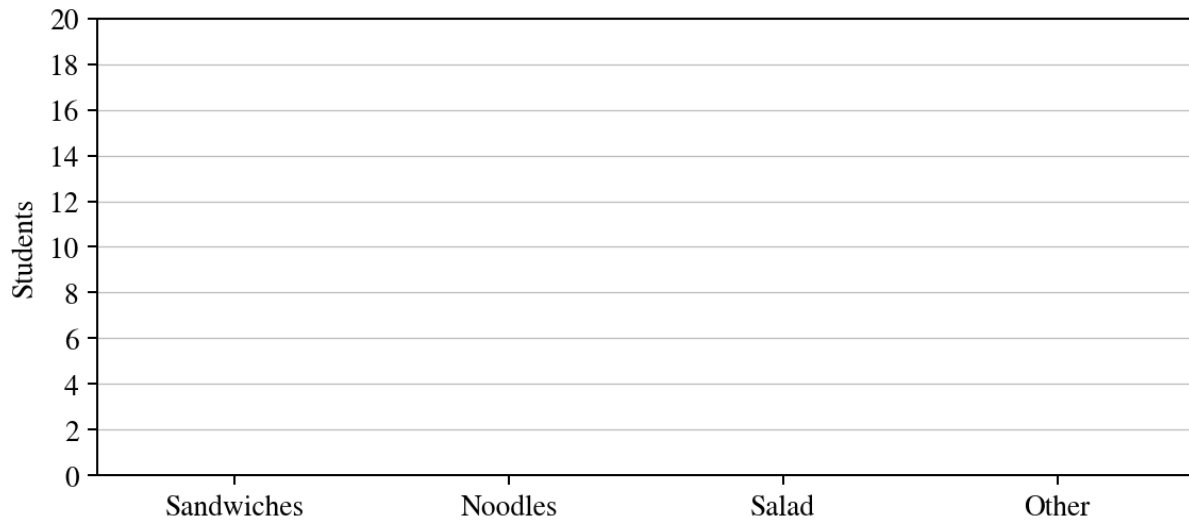
(a) Draw a pictograph with one symbol representing 4 students and include a key.

(b) Draw a bar chart with labelled axes.

(c) Draw a strip graph of total length 10 cm.

(d) Calculate the sector angles and draw a pie chart.

(e) State the modal category and its percentage of the total.



Statistics Continued

Question 59

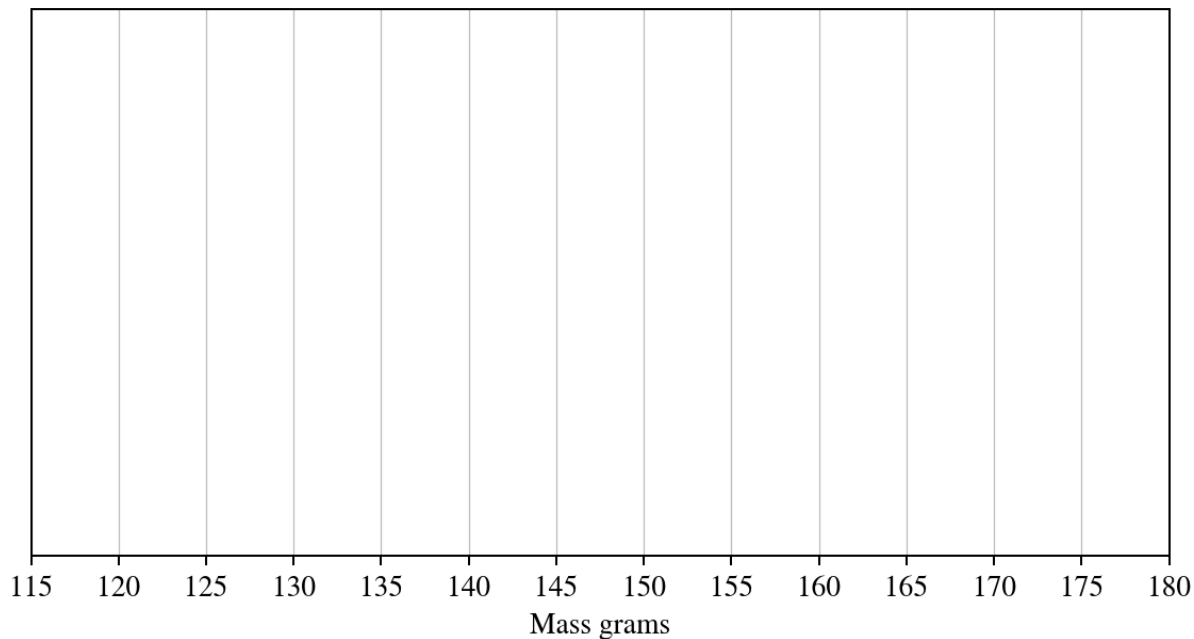
The masses, in grams, of 12 apples are:

121, 134, 138, 142, 145, 145, 151, 156, 160, 164, 168, 172.

(a) Construct an ordered stem and leaf diagram with a key.

(b) Find the median, lower quartile, upper quartile, interquartile range and range. Use the median of each half for quartiles.

(c) Draw a box and whisker plot and describe the centre and spread.



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Statistics Continued

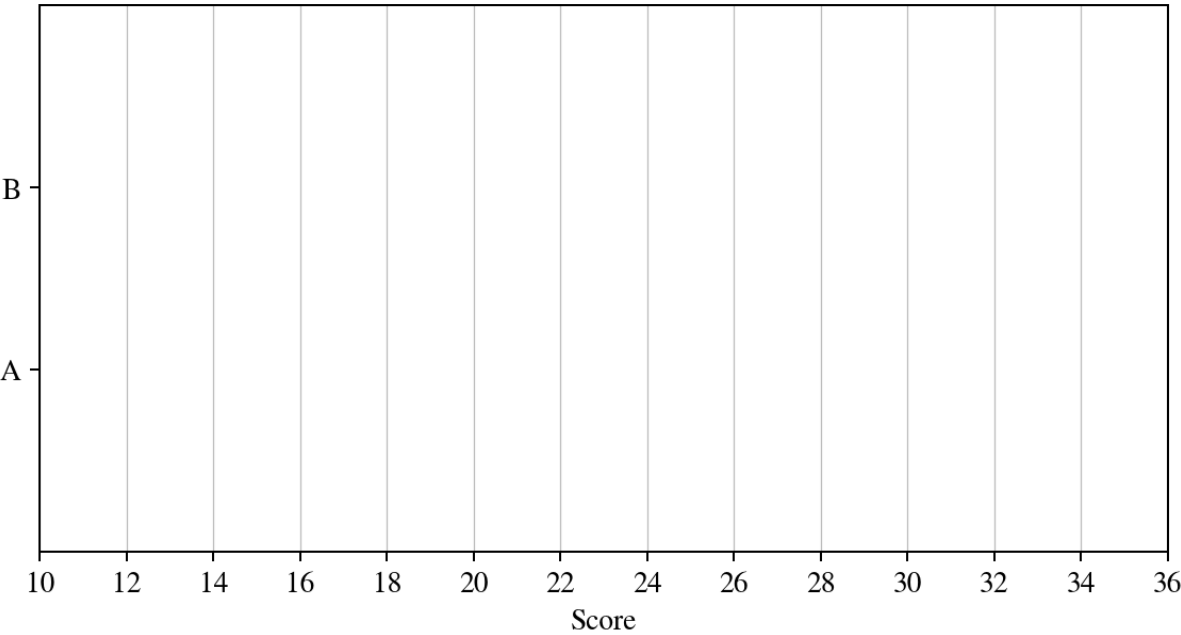
Question 60

The scores from two groups are:

Group A: 12, 14, 15, 17, 18, 21, 23, 24, 26, 30.

Group B: 11, 13, 16, 19, 22, 24, 25, 27, 29, 34.

- (a) Make a back to back stem and leaf diagram with a key.
- (b) Draw two box plots on the same scale. Use median of halves quartiles.
- (c) Compare their medians and IQRs in context.



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Statistics Continued

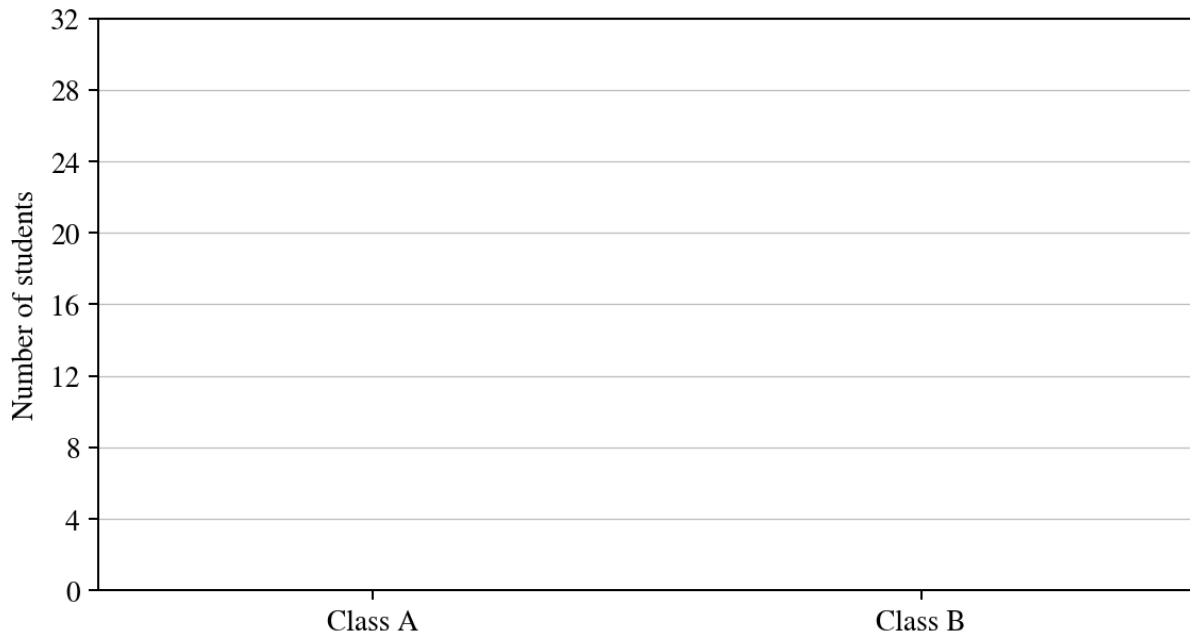
Question 61

Two classes record travel method.

Class *A*: walk 9, bus 12, car 7.

Class *B*: walk 6, bus 15, car 9.

- (a) Draw a composite stacked bar chart, with one bar for each class.
(b) Which class has the larger proportion travelling by bus? Show calculations.
(c) A student claims “More bus users proves Class *B* lives farther away.” Explain why this conclusion is not supported.



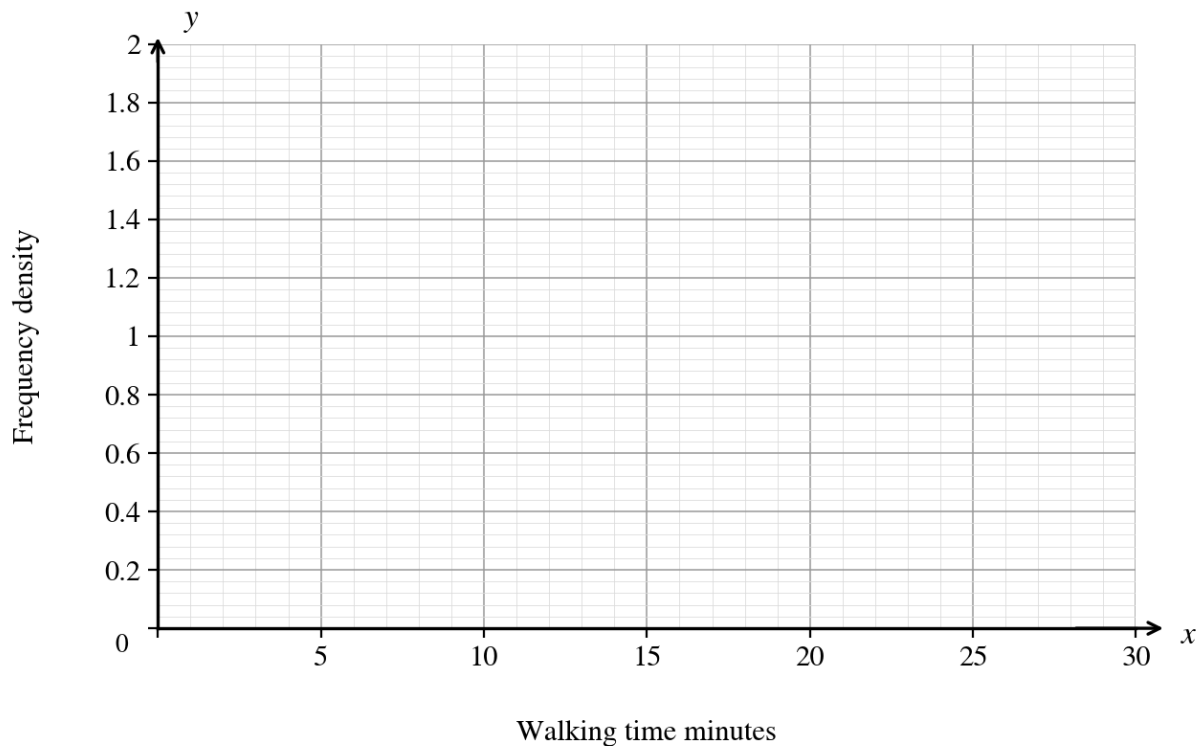
Statistics Continued

Question 62

Walking times, in minutes, are grouped as follows:

$0 \leq t < 5$: 4; $5 \leq t < 10$: 9; $10 \leq t < 20$: 12; $20 \leq t < 30$: 5.

- (a) Explain why the data are continuous.
- (b) Calculate frequency densities and draw a histogram.
- (c) Find the proportion taking at least 10 minutes.
- (d) A chart uses bar heights 4, 9, 12 and 5 with these unequal class widths. Explain its error.



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Statistics Continued

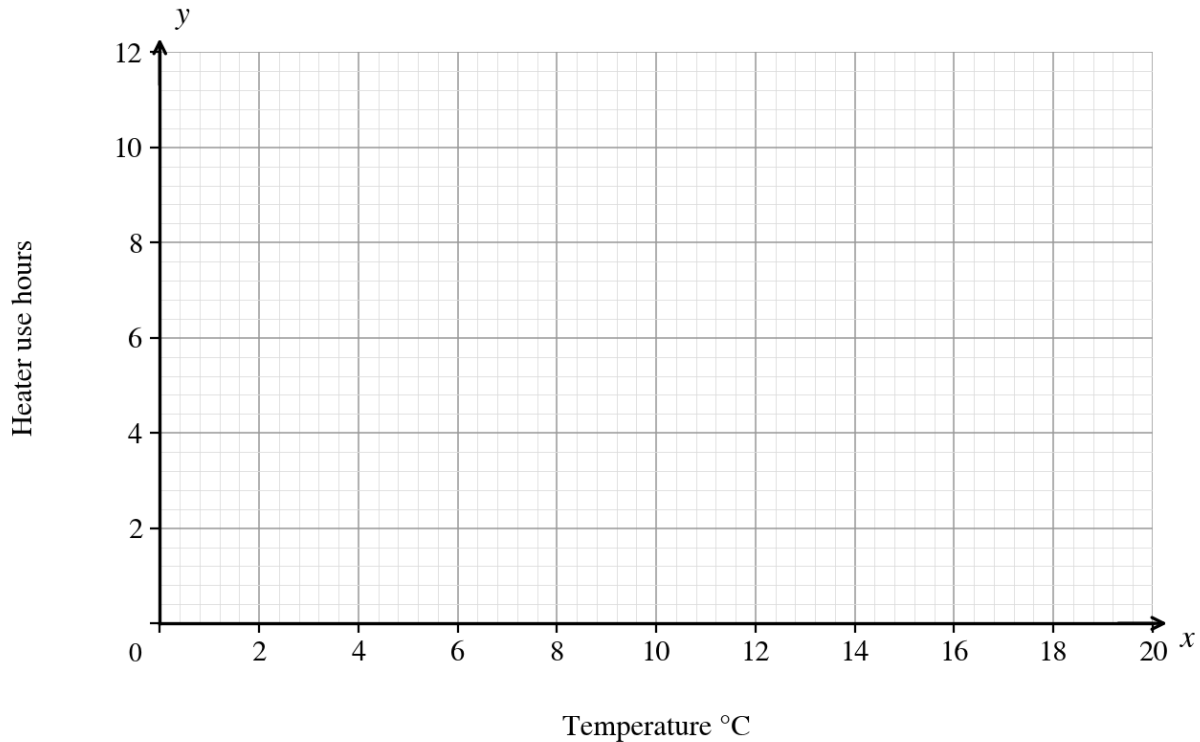
Question 63

A technician measures outdoor temperature and daily heater use:

Temperature $^{\circ}\text{C}$: 4, 6, 8, 10, 12, 14, 16, 18.

Heater use hours: 9.5, 8, 8.5, 6.5, 6, 4.5, 5, 3.

- (a) Draw a scatterplot with temperature on the horizontal axis.
- (b) Describe the direction and strength of association.
- (c) Draw a line of best fit and estimate heater use at 11°C .
- (d) Explain why predicting heater use at 32°C is unreliable.
- (e) Does this graph prove temperature alone determines heater use? Explain.



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Probability

Question 64

A fair four sided die is numbered 1, 2, 3, 4. A fair coin is tossed independently.

- (a) List the complete sample space using ordered pairs (number, coin result).
- (b) Find $P(\text{even number and heads})$.
- (c) Find $P(\text{number is 1 or number is 4})$. Explain why these events are mutually exclusive.
- (d) Explain the difference between mutually exclusive and independent events here.

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Question 65

Design an experiment to estimate the probability of getting a number greater than 4 on a six sided die.

- (a) Describe how to run and record 120 trials fairly.
- (b) In 120 trials, 43 results are greater than 4. Find the empirical probability.
- (c) Compare it with the theoretical probability for a fair die.
- (d) Use the empirical result to predict the count in 600 trials. Explain why this is not a guarantee.
- (e) Conduct 30 trials yourself, recording every outcome. Compare your relative frequency with $\frac{1}{3}$.

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Probability Continued

Question 66

A delivery is on time with probability 0.8. If it is on time, the probability of a satisfied customer is 0.9. If it is late, that probability is 0.35.

- (a) Draw a complete probability tree.
- (b) Find $P(\text{on time and satisfied})$.
- (c) Find $P(\text{satisfied})$.
- (d) In 500 similar deliveries, estimate the number of satisfied customers.

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Question 67

A pouch holds 4 yellow and 3 purple beads. Two are selected at random without replacement.

- (a) Draw a tree showing both selections.
- (b) Find $P(\text{both yellow})$.
- (c) Find $P(\text{one of each colour})$.
- (d) Find $P(\text{at least one purple})$, using a complement.

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Probability Continued

Question 68

A club survey gives the following counts:

Year 9: cycle 12, walk 8, bus 10.

Year 10: cycle 9, walk 15, bus 6.

A student is chosen at random from all surveyed students.

- (a) Make a two way table including totals.
- (b) Find $P(\text{Year 10 and walks})$.
- (c) Find $P(\text{cycles or Year 9})$.
- (d) Given the student walks, find $P(\text{Year 10})$.

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Sets and Venn Diagrams

Question 69

Let $U = \{1, 2, 3, \dots, 15\}$, $A = \{\text{even numbers in } U\}$ and $B = \{\text{multiples of 5 in } U\}$.

- (a) List A and B and draw a Venn diagram placing every element.
- (b) List $A \cap B$, $A \cup B$ and A' .
- (c) Find $n(A \cup B)$ and explain the notation n .
- (d) Shade $A' \cap B$ and list its elements.

Question 70

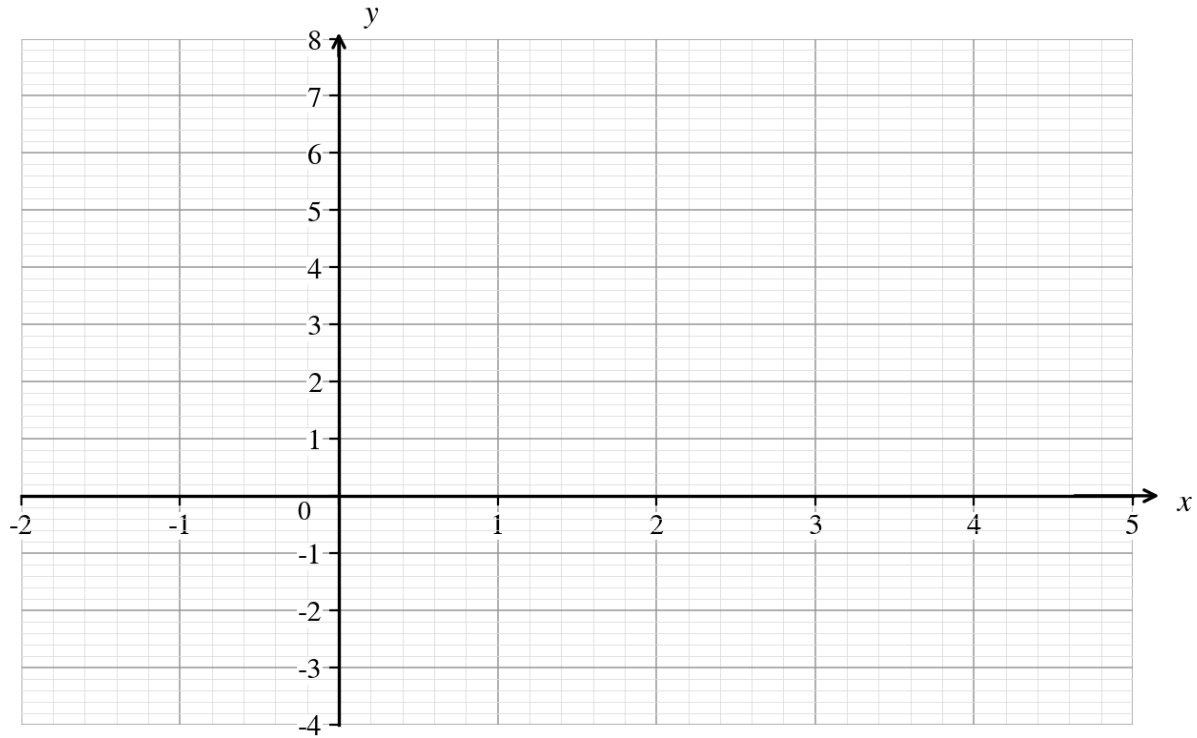
Among 90 students, 48 study French, 37 study Spanish and 19 study both.

- (a) Draw a Venn diagram with all four region counts.
- (b) Find the number studying neither language.
- (c) Find $P(\text{exactly one language})$ for a randomly chosen student.
- (d) Given that a student studies French, find $P(\text{also studies Spanish})$.
- (e) Use set notation for students studying Spanish but not French.

Graphing Functions

Question 71

- (a) Complete tables for $y = 2x - 1$ and $y = -x + 5$ for $x = -1, 0, 1, 2, 3, 4$.
(b) Draw both lines on the grid.
(c) Use their intersection to solve $2x - y = 1$ and $x + y = 5$.
(d) Check your solution by substitution.



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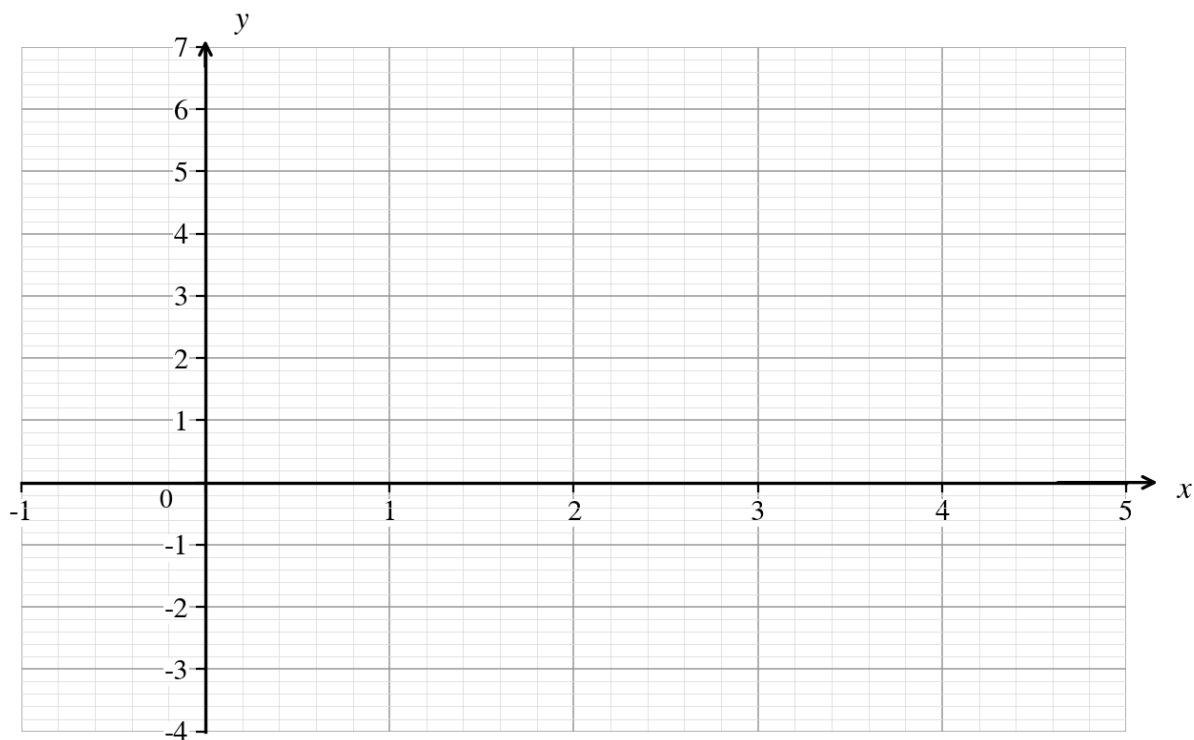
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Graphing Functions Continued

Question 72

- (a) Complete a table for $y = x^2 - 4x + 1$ for integer x from -1 to 5 .
(b) Draw a smooth curve through the points.
(c) State the line of symmetry and turning point.
(d) Draw $y = 2$ and use the intersections to solve $x^2 - 4x + 1 = 2$. Give answers to 1 decimal place.
(e) Explain what the intersections represent.



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Graphing Functions Continued

Question 73

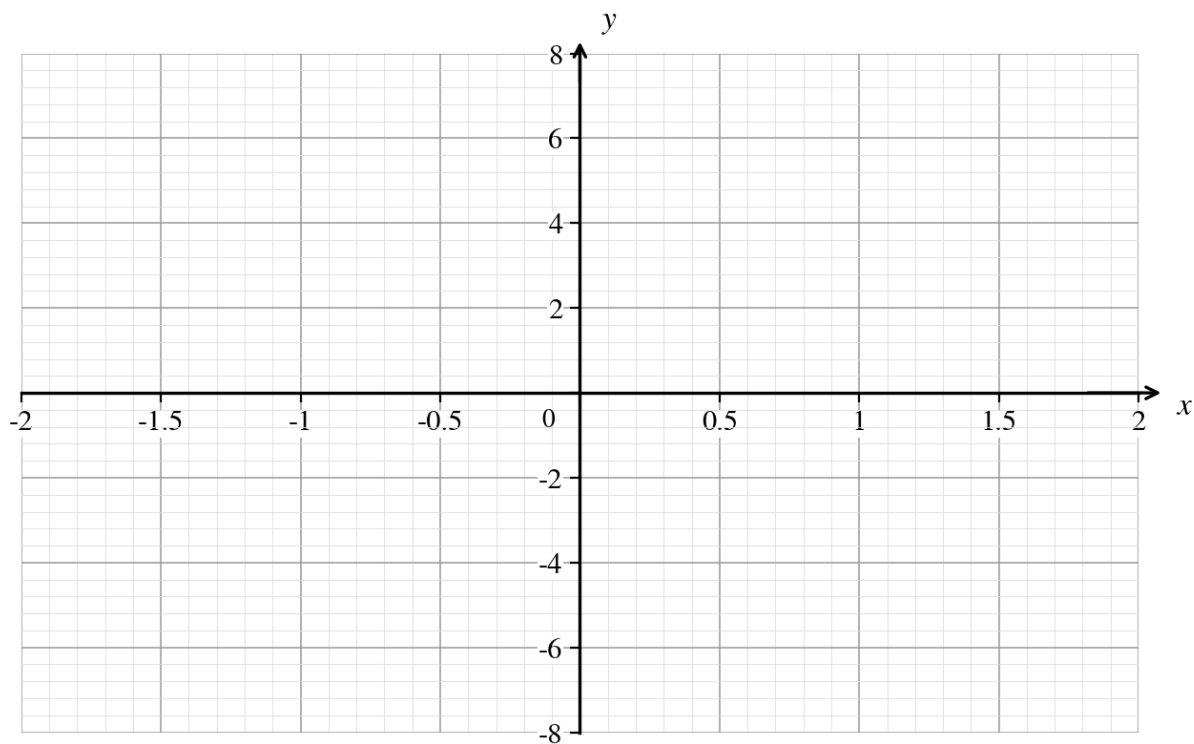
On the grid draw $y = x^2$ and $y = x^3$ for $-2 \leq x \leq 2$.

(a) Use $x = -2, -1.5, -1, -0.5, 0, 0.5, 1, 1.5, 2$ to build tables.

(b) State the symmetry of each graph.

(c) Find their points of intersection from the graph.

(d) Which graph has negative y values when $x < 0$?

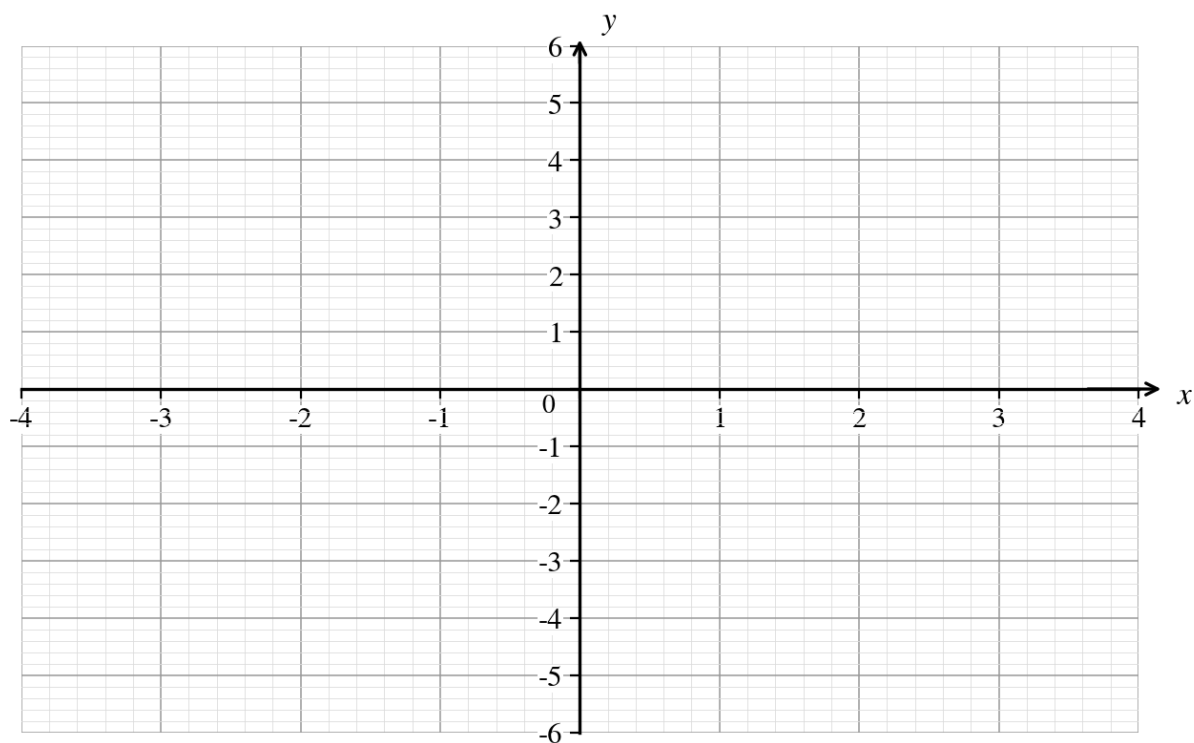


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Graphing Functions Continued

Question 74

- (a) Build a table and draw $y = \frac{1}{x}$ using $x = -4, -2, -1, -0.5, 0.5, 1, 2, 4$.
- (b) Explain why $x = 0$ is excluded.
- (c) Name the two asymptotes and explain why the branches must not be joined through the origin.
- (d) Sketch $y = \frac{3}{x}$ and state how it relates to $y = \frac{1}{x}$.



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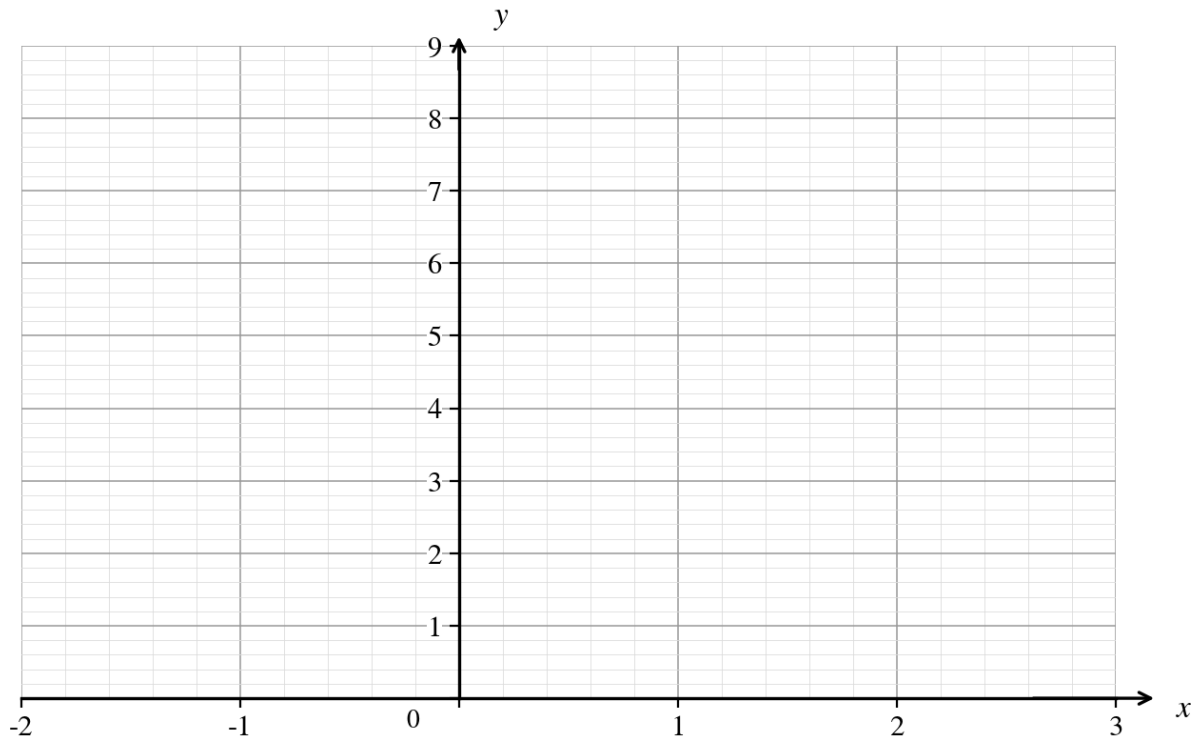
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Graphing Functions Continued

Question 75

- (a) Complete a table for $y = 2^x$ for $x = -2, -1, 0, 1, 2, 3$.
(b) Draw the graph and state its y intercept.
(c) A culture starts with 300 cells and doubles each hour. Write a formula for N after t hours and find N after 5 hours.
(d) Use your graph to estimate the time when $N = 1800$. Explain the link to the graph.



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Supplementary Proportionality

Question 76

- (a) The cost C of fabric is directly proportional to its length L . If 3.5 m costs \$28, find the formula and cost of 8.2 m.
- (b) The time T to complete a job is inversely proportional to the number n of equally productive workers. Six workers take 15 hours. Find T in terms of n and the time for 10 workers. State an assumption.

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Question 77

- Printing cost is directly proportional to the number of leaflets. 250 leaflets cost \$45. Production time is inversely proportional to the number of identical printers for a fixed order. One printer makes 500 leaflets in 40 minutes.
- (a) Find the cost of 1400 leaflets.
 - (b) Find the time for 1400 leaflets using 4 printers.
 - (c) A 10% discount applies to orders over 1000 leaflets. Find the discounted cost per leaflet.

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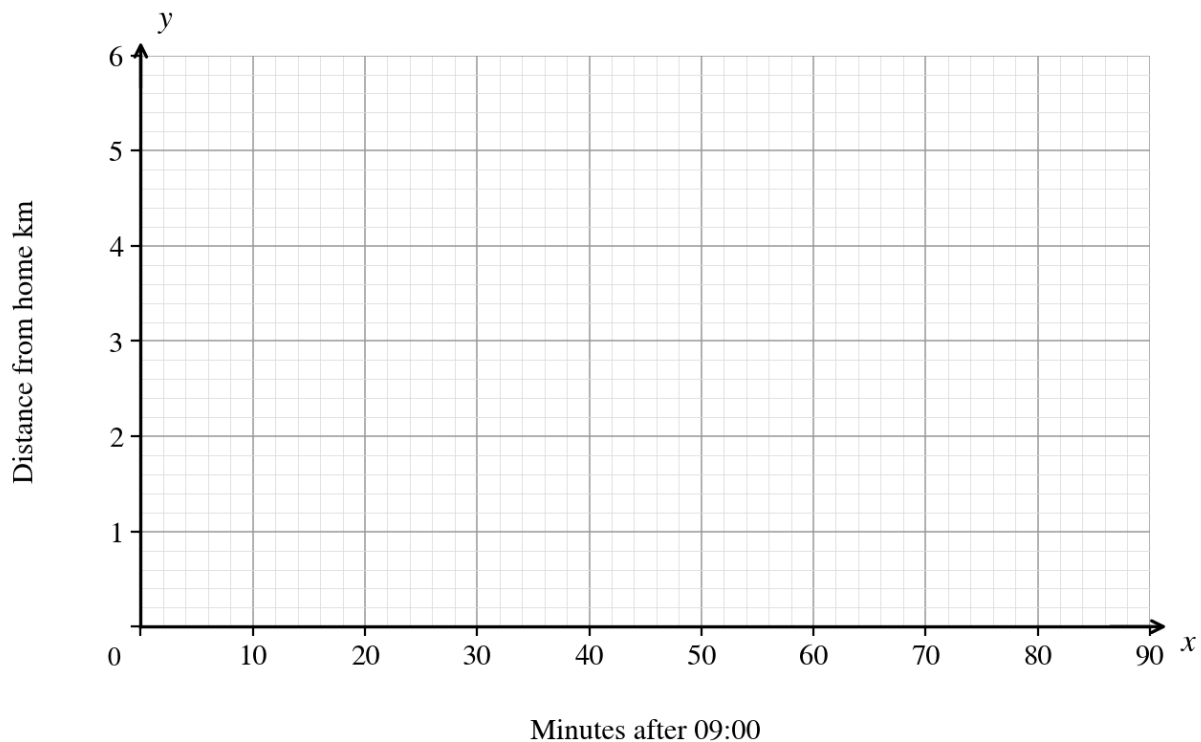
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Supplementary Travel and Conversion Graphs

Question 78

A walker starts 0 km from home at 09:00, reaches 3 km at 09:40, rests until 10:00, then walks home arriving at 10:30. Each walking stage has constant speed.

- (a) Draw a distance from home against time graph.
- (b) Find the speed during each walking stage in $\frac{\text{km}}{\text{h}}$.
- (c) Find total distance travelled and average speed for the whole outing, including the rest.
- (d) Explain the meaning of the horizontal and downward sloping sections.



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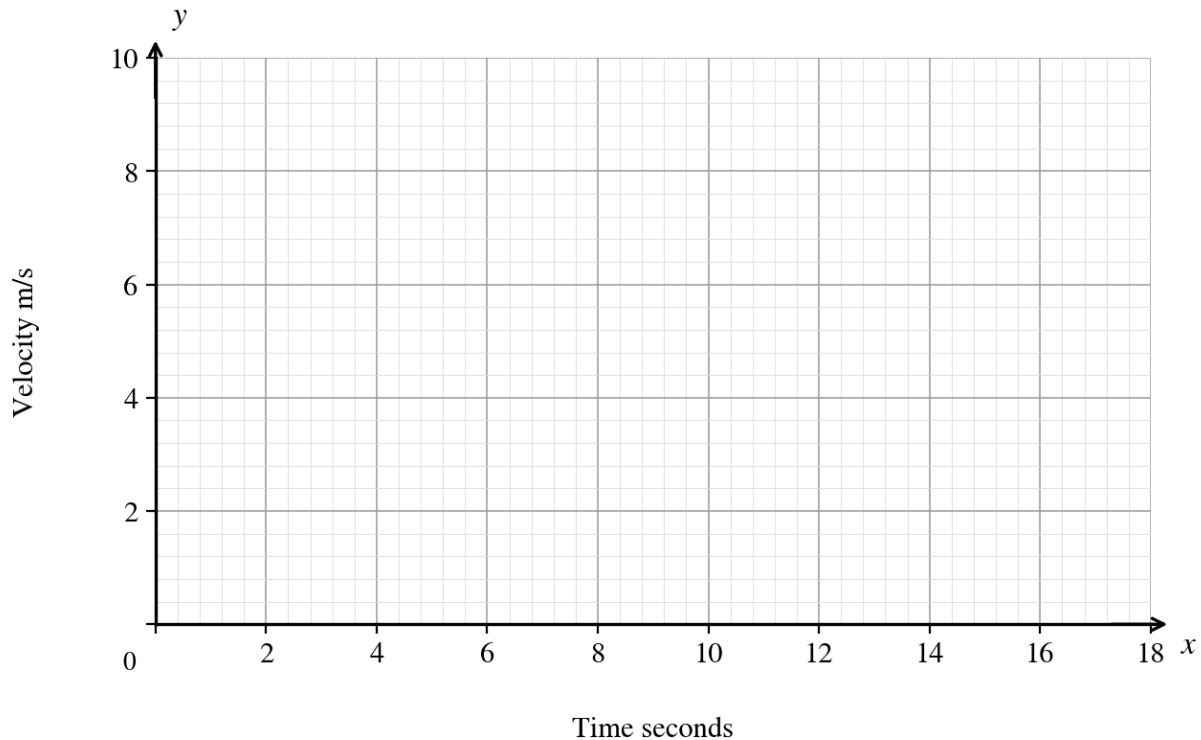
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Supplementary Travel and Conversion Graphs Continued

Question 79

A cyclist's velocity is $0 \frac{\text{m}}{\text{s}}$ at $t = 0$, rises uniformly to $8 \frac{\text{m}}{\text{s}}$ at $t = 4 \text{ s}$, stays at $8 \frac{\text{m}}{\text{s}}$ until $t = 14 \text{ s}$, then falls uniformly to 0 at $t = 18 \text{ s}$.

- (a) Draw a velocity time graph.
- (b) Find the acceleration during the first stage.
- (c) Use areas to find the total distance.
- (d) Find the average speed for the 18 seconds.



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Supplementary Travel and Conversion Graphs Continued

Question 80

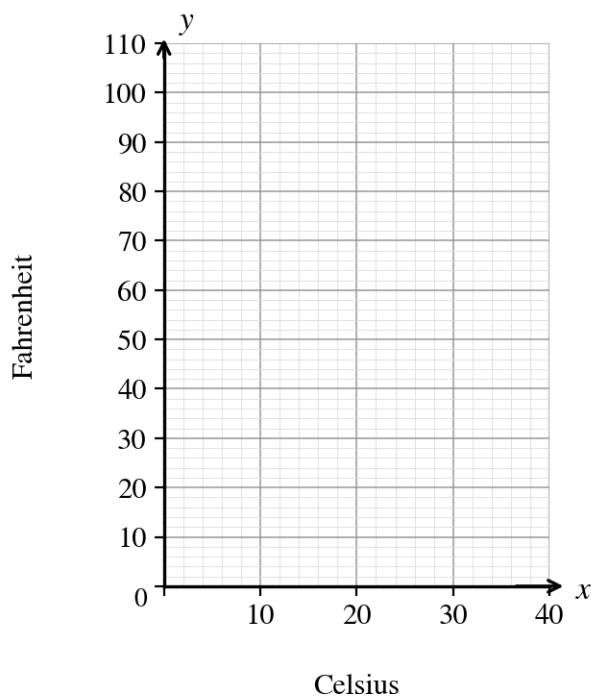
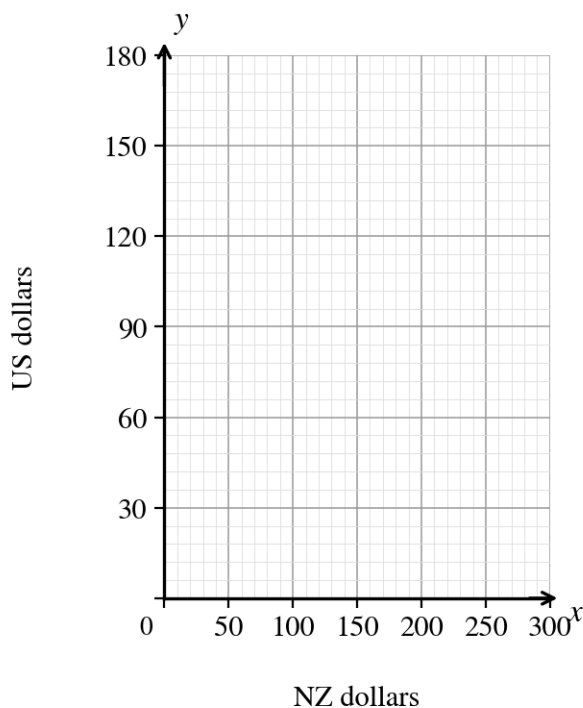
For this question, 1 *NZ* dollar exchanges for 0.60 *US* dollars and fees are ignored.

(a) Draw a conversion graph for 0 to 300 *NZ* dollars.

(b) Use it to convert *NZ*\$180 to *US* dollars and *US*\$135 to *NZ* dollars.

(c) The temperature scales satisfy $F = 1.8C + 32$. On a separate set of axes, draw the conversion line for $0 \leq C \leq 40$.

(d) Find the Fahrenheit equivalent of 25°C and the Celsius equivalent of 86°F .



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Supplementary Extension Algebra

Question 81

Simplify, stating excluded values.

(a) $\frac{2}{x-1} + \frac{3}{x+2}$.

(b) $\frac{x+4}{x-2} - \frac{2}{x+1}$.

(c) $\left[\frac{x^2-9}{x^2-x-6}\right] \times \left[\frac{x-3}{x+3}\right]$.

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Question 82

Solve, checking excluded values.

(a) $\frac{3}{x-2} = \frac{2}{x+1}$.

(b) $\frac{1}{x} + \frac{1}{x+2} = \frac{3}{4}$.

(c) A rectangle has width w metres, length 3 metres longer, and area 70 m^2 . Form and solve an equation and find the perimeter.

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