Secondary 3 Mathematics · Practice Worksheet · tutorinmontreal.ca

Missing Measurements, Projections and Lines

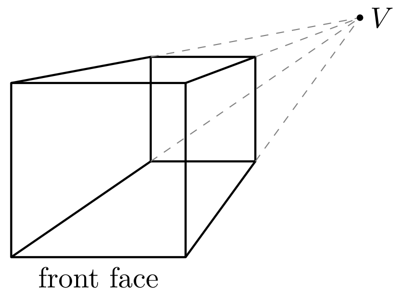
Name: ______________________________ Date: ______________

Concepts

- Central Projections With One or Two Vanishing Points
- Finding Missing Measurements in Plane Figures by Solving a System of Equations
- Missing Measurements According to Area: Decomposable and Truncated Solids
- Missing Measurements in Solids (theory)
- Missing Measurements of Solids from the Area
- Missing Measures from a Volume: Decomposable and Truncated Solids
- Orthogonal Projections (Multiple Views)
- Parallel Projections (Cavalier and Axonometric)
- Projections and Perspectives
- The Relative Position of Two Lines
- The Slope of a Line

Central Projections With One or Two Vanishing Points

1. The drawing below shows a rectangular box (a shipping crate) in central perspective. The point V is marked.



a) How many vanishing points does this drawing use?

b) Which face of the crate is drawn in its true shape *and* at full size? Say how the drawing of the back face of the crate differs from it.

c) The four depth edges are not drawn in their true length. Say what governs their direction in the drawing.

d) If the artist redrew the same crate with V moved far to the *left* of the front face, which side face of the crate would then be visible?

Finding Missing Measurements in Plane Figures by Solving a System of Equations

2. A rectangular community garden in Rosemont is enclosed by 96 m of fencing. Its length is 8 m less than three times its width.

a) Using L for the length and w for the width, write a system of two first-degree equations.

b) Solve the system by substitution.

c) Give the area of the garden, and check your two dimensions against both of the original statements.

Missing Measurements According to Area: Decomposable and Truncated Solids

3. A concrete bollard at the entrance of a parking lot is made of two stacked rectangular prisms: a lower block with a square base of side 12 cm and unknown height h, and, centred on top of it, a cube of edge 6 cm. The whole outside surface — including the base it stands on — is to be painted, and it takes 720 cm^2 of paint coverage.

a) Write the total exterior area of the solid as an expression in h. Remember that the top of the lower block is only partly exposed.

b) Find h.

Missing Measurements in Solids

4. Each situation below asks for one missing measurement of a solid. For each one, (i) name the formula you would turn into an equation, (ii) say how many unknowns that equation contains, and (iii) find the measurement or explain why it cannot be found from what is given.

a) A cube has a total surface area of 294 cm^2. Find its edge.

b) A cylinder has a volume of 500π cm^3 and a height of 20 cm. Find its radius.

c) A cone has a volume of 96π cm^3. Find its radius.

d) A rectangular prism with a square base has a volume of 240 cm^3 and a height of 15 cm. Find the side of its base.

Missing Measurements of Solids from the Area

5. Find the missing measurement in each solid. Work with π as a symbol rather than as a decimal, and give exact answers.

a) A closed cylindrical soup can has a radius of 5 cm and a total surface area of 130π cm^2. Find its height.

b) A cone-shaped party hat (no base) has a slant height of 12 cm and a lateral area of 96π cm^2. Find the radius of its opening.

c) A ball has a surface area of 144π cm^2. Find its radius.

Missing Measures from a Volume: Decomposable and Truncated Solids

6. A garden shed is a decomposable solid: a rectangular prism 6 m long and 4 m wide, of unknown height h, with a roof in the shape of a triangular prism sitting on top. The roof's triangular face has a base of 4 m (the width of the shed) and a height of 1.5 m, and the roof is 6 m long, like the shed. The whole shed encloses 90 m^3 of air.

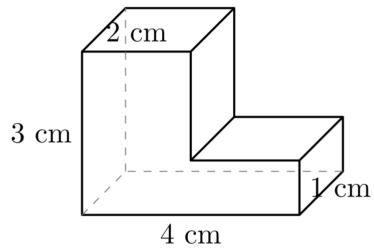
a) Find the volume of the roof.

b) Find h, the height of the walls.

c) How tall is the shed from the ground to the ridge of the roof?

Orthogonal Projections (Multiple Views)

7. The step-shaped block below is 2 cm deep (front to back) throughout. Its front face is drawn in true size.



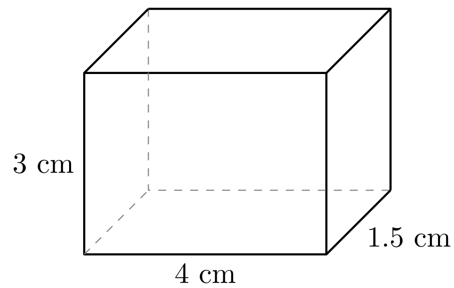
a) Sketch the front view. Give its outside dimensions.

b) Sketch the top view. Give its outside dimensions.

c) Sketch the right side view. Give its outside dimensions, and explain why it is a plain rectangle even though the block has a step in it.

Parallel Projections (Cavalier and Axonometric)

8. Below is a cavalier perspective of a rectangular tissue box. The front face is drawn in true size. The receding edges are drawn at 45° with a reduction factor of $\frac{1}{2}$, and each measures 1.5 cm on the drawing.



a) What is the real depth of the box?

b) Give the real dimensions of the box, then its volume.

c) Which edges of the drawing are in true length and which are not? Say how many edges are in each group.

d) Name one thing this drawing shows correctly that a central perspective drawing of the same box would not.

Projections and Perspectives

9. Each part below describes a drawing; no drawing is printed here. Name the type of projection each one uses — orthogonal projection (multiple views), cavalier perspective, isometric (axonometric) perspective, central perspective with one vanishing point, or central perspective with two vanishing points — and give the clue that decides it.

a) A plan of a garage made of three separate drawings labelled *front*, *top* and *right side*, each carrying true measurements.

b) A drawing of a bookcase whose front face is a true-size rectangle and whose depth edges are all at 45° and half their real length.

c) A drawing of a metro corridor in which the floor lines, the ceiling lines and the tops of all the doors meet at a single point.

d) A drawing of a cube in which the edges run along three axes at 120° to one another and no face is a square.

e) A drawing of a street corner in which the vertical edges stay vertical while the two visible walls recede toward two different points on the horizon.

Finally: which of the five keep parallel edges of the solid parallel on the drawing?

The Relative Position of Two Lines

10. In the Cartesian plane, line d_1 passes through $A(-2, 1)$ and $B(4, 5)$.

a) Find the slope of d_1.

b) Line d_2 passes through $C(0, -3)$ and $D(9, 3)$. Find its slope, then state the relative position of d_1 and d_2. Justify why they are not the same line.

c) Line d_3 passes through $E(2, 5)$ and $F(6, -1)$. Find its slope, then state the relative position of d_1 and d_3, with the reason.

d) Line d_4 passes through $G(1, 3)$ and $H(7, 7)$. Find its slope, then state the relative position of d_1 and d_4. Be careful — equal slopes are not the whole story.

The Slope of a Line

11. Find the slope in each case. Give exact values, and say what the sign of each slope means.

a) The line through $M(-4, 7)$ and $N(2, -5)$.

b) An access ramp that rises 24 cm over a horizontal run of 3 m. (Read the units carefully.)

c) The line through $T(3, -2)$ and $U(7, -2)$.

d) The line through $V(5, 1)$ and $W(5, 9)$.

Synthesis — drawing on several sheets in this topic

12. A skatepark is getting a new concrete launch ramp. Seen from the side it is a right triangle: the sloping surface rises 1 m over a horizontal run of 4 m. The ramp is a triangular prism, and its width w (across the direction skaters travel) is still to be decided.

a) Find the slope of the ramp's sloping surface, as a fraction and as a decimal.

b) The city will pour exactly 6 m^3 of concrete. Find w.

c) Describe the ramp's top view and its right side view, with dimensions.

d) A safety rule says the ramp's slope must not exceed 0.3. If the run stayed at 4 m, what is the greatest rise allowed? Would a rise of 1.5 m pass?