Practice Paper 1

Proportion | Congruence and similarity | Pythagoras | Trigonometry

Name: _____ Class: _____ Date: _____

30 questions | Answer all questions and show your working.

Give exact answers unless a level of accuracy is stated.

A calculator may be used except where a question states otherwise.

1. y is directly proportional to x. When x = 4, y = 6.

(a) Find the equation connecting y and x.

(b) Find y when x = 10.

(c) Find x when y = 30.

2. y is inversely proportional to x. When x = 6, y = 12.

(a) Find the equation connecting y and x.

(b) Find y when x = 8.

(c) Find x when y = 9.

3. y is directly proportional to the square of x. When x = 3, y = 18.

(a) Find the equation connecting y and x.

(b) Find y when x = 7.

(c) Find the positive value of x when y = 50.

4. F is directly proportional to the square root of h. When h = 16, F = 12.

(a) Find the equation connecting F and h.

(b) Find F when h = 81.

(c) Find h when F = 18.

5. V is directly proportional to the cube of r. When r = 3, V = 18.

(a) Find the equation connecting V and r.

(b) Find V when r = 6.

(c) By what factor does V change when r doubles?

6. y is inversely proportional to the square of x. For a particular x, y = 18. Find the new value of y when x is changed as follows.

(a) x is halved.

(b) x is tripled.

(c) x is increased by 25%.

7. 12 workers, working 6 hours a day, complete a job in 20 days. All workers work at the same constant rate.

(a) How many days would 8 workers take at 5 hours a day?

(b) Find the least whole number of workers needed to finish in 10 days at 8 hours a day.

8. 4 identical machines produce a batch in 15 hours. Production time is inversely proportional to the number of machines.

(a) Find the time for 6 machines to produce one batch.

(b) Find the total machine-hours needed for two batches.

9. A spring has natural length 12 cm. Its extension e cm is directly proportional to a load m kg. A load of 4 kg makes its total length 24 cm.

(a) Find the equation connecting e and m.

(b) Find its total length under a load of 7 kg.

(c) Find the load when its total length is 30 cm.

10. For a fixed journey, time t hours is inversely proportional to speed v km/h. At 50 km/h, the journey takes 2 hours.

(a) Find the equation connecting t and v.

(b) Find the journey time at 80 km/h.

(c) By what percentage must speed increase to reduce the journey time by 25%?

11. Triangles ABC and DEF are similar, with A corresponding to D, B to E and C to F. Their side lengths are marked.

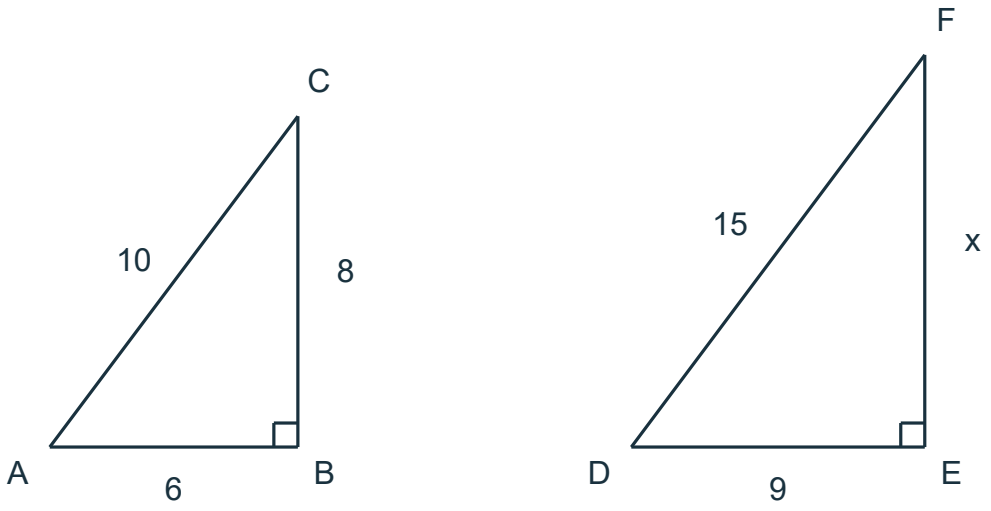


Diagram not drawn to scale.

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

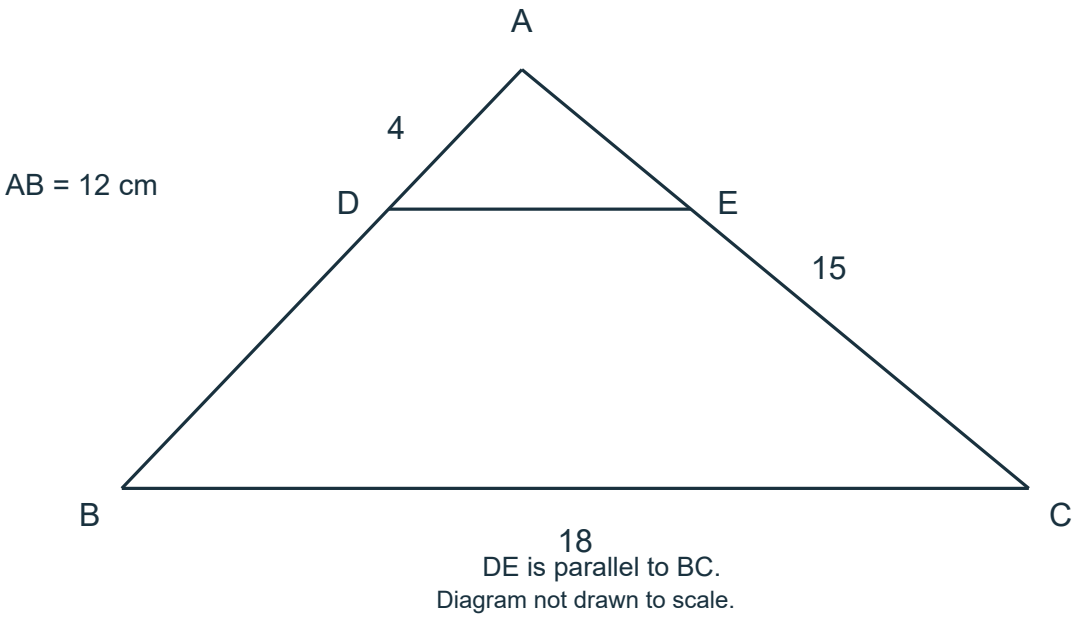
(b) Find x.

(c) Find the perimeter of DEF.

(d) Find the ratio area DEF : area ABC as a multiplier.

12. Two similar triangles have areas 72 cm² and 32 cm², respectively. A side of the first triangle is 15 cm. Find the corresponding side of the second triangle and the ratio of their perimeters.

13. In triangle ABC, D lies on AB and E lies on AC. DE is parallel to BC. The lengths shown are in cm.



DE is parallel to BC.
Diagram not drawn to scale.

(a) Find AE.

(b) Find DE.

(c) Find area ADE as a fraction of area ABC.

14. A vertical lamp post is 6 m tall. A person stands 3.5 m from its base. The person's shadow is 1.5 m long. The lamp, person and shadow tip are in the same vertical plane. Find the person's height using similar triangles.

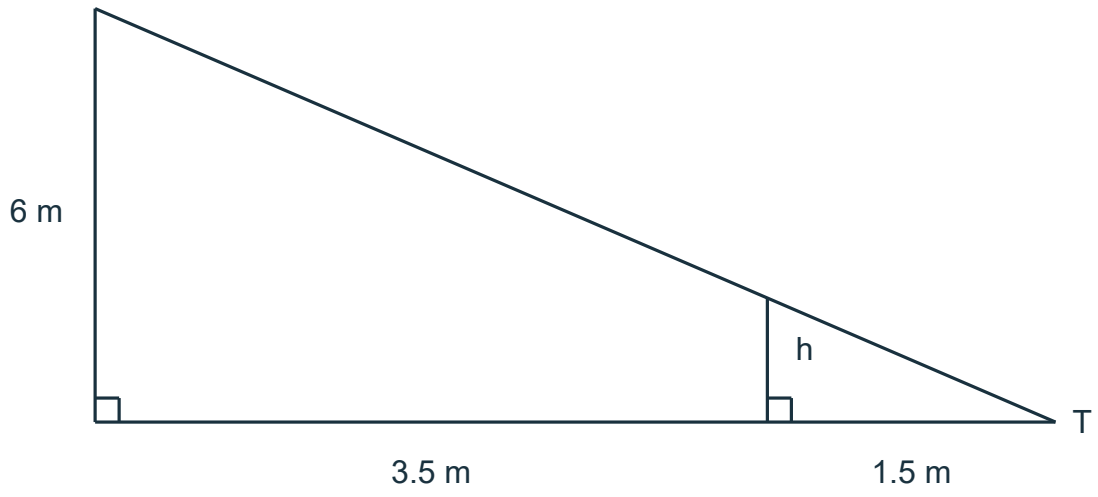


Diagram not drawn to scale.

15. A map has scale 1:2500.

(a) Find the actual distance represented by 6 cm.

(b) Find the actual area represented by 12 cm².

16. The two triangles have the side lengths shown. Decide whether they are congruent. State the criterion and list the vertices corresponding to A, B and C, in that order.

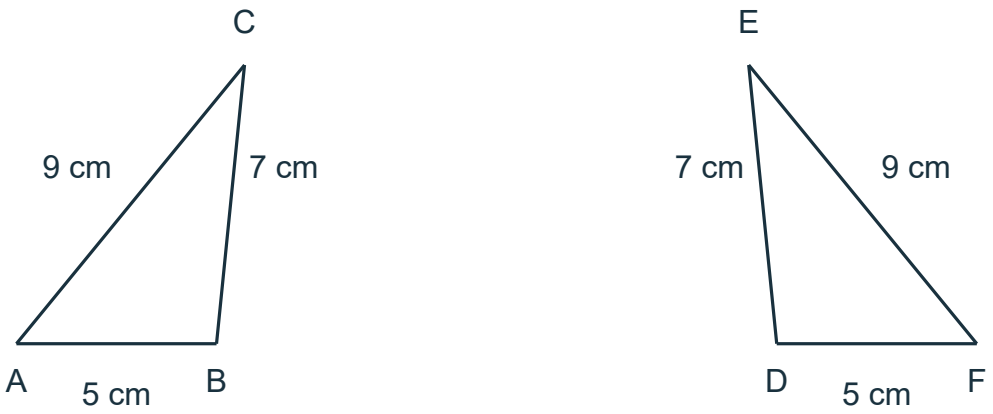


Diagram not drawn to scale.

17. In the diagram, AB = DE = 6 cm, AC = DF = 9 cm and angle BAC = angle EDF = 52°. Decide whether the triangles are congruent. State the criterion and identify the side equal to BC.

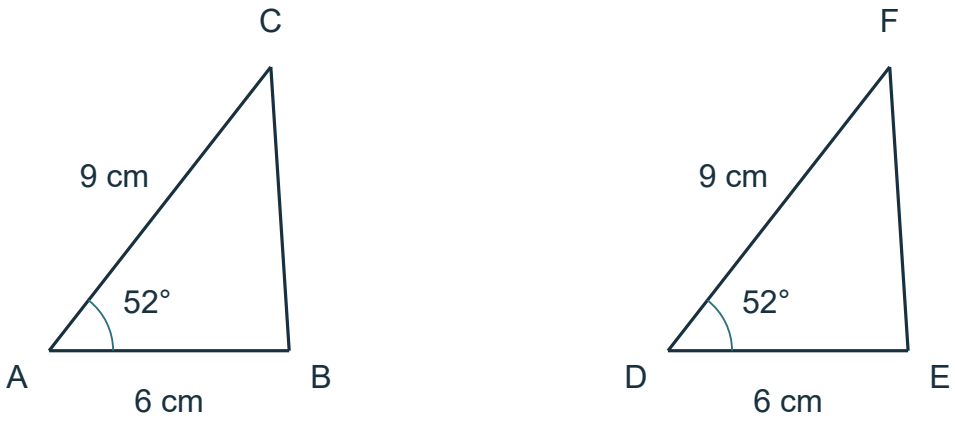


Diagram not drawn to scale.

18. Two triangles each have sides of 5 cm and 8 cm. Each also has an angle of 35°, but that angle is not between the two stated sides. Does this information guarantee congruence? State why.

19. Triangles ABC and PQR are congruent in the stated order. In ABC, BC = 8 cm, angle ABC = 61° and angle ACB = 47°. In PQR, PQ = 10 cm.

(a) Find QR and AB.

(b) Find angle QPR.

20. Two similar triangles have corresponding side lengths 3 cm and 5 cm. Their perimeters are 72 cm and an unknown length. Each triangle is enlarged to the same triangle, using positive integer scale factors X and Y respectively.

(a) Find the smallest possible X and Y.

(b) Find the perimeter of the common enlarged triangle.

21. Triangle ABC is right-angled at B. The lengths shown are in cm.

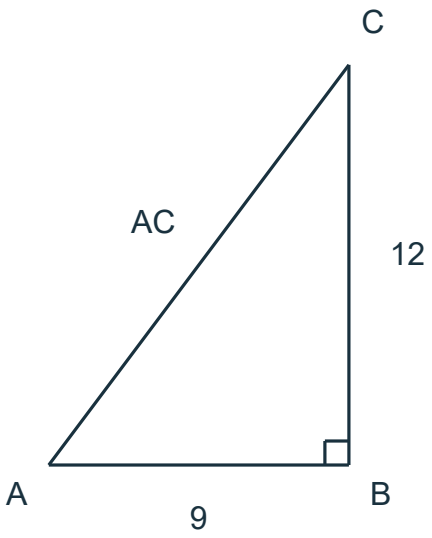


Diagram not drawn to scale.

(a) Find AC.

(b) Find its area.

22. A triangle has side lengths 5, 12 and 13 cm. A second triangle has side lengths 5, 12 and 14 cm.

(a) Decide whether the first triangle is right-angled. State the theorem used.

(b) Decide whether the second triangle is right-angled.

23. A rectangular field measures 7 m by 24 m. A straight path joins opposite corners.

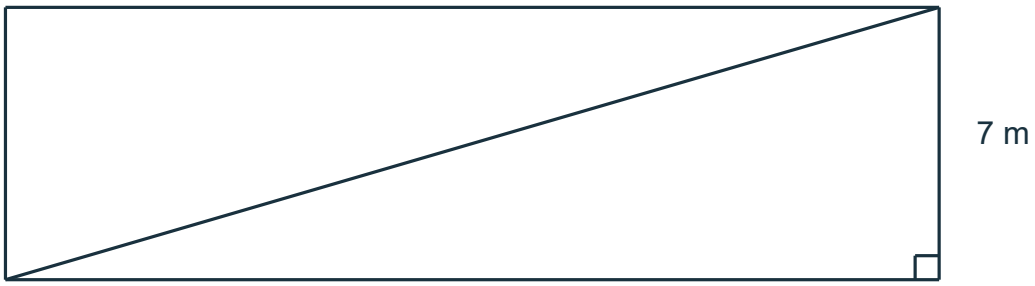


Diagram not drawn to scale.

(a) Find the length of the path, to 3 significant figures.

(b) How much shorter is the path than walking along the two adjoining sides? Give 3 significant figures.

24. A 10 m ladder rests against a vertical wall. Its foot is 6 m from the wall. It is then moved 2 m farther from the wall while its top remains against the wall. Give both answers to 3 significant figures.

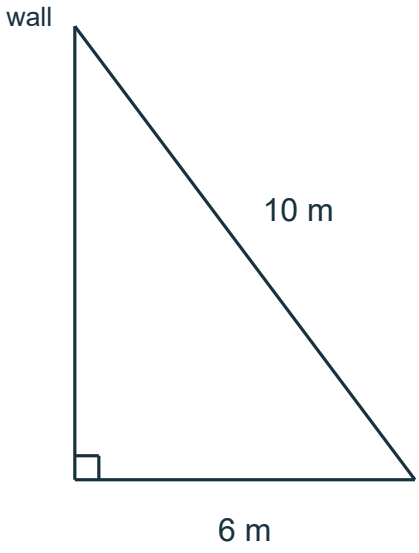


Diagram not drawn to scale.

(a) Find its initial height up the wall.

(b) How far does the top slide down?

25. Triangle ABC is right-angled at B. BD is perpendicular to AC. AB = 6 cm, BC = 8 cm and AC = 10 cm.

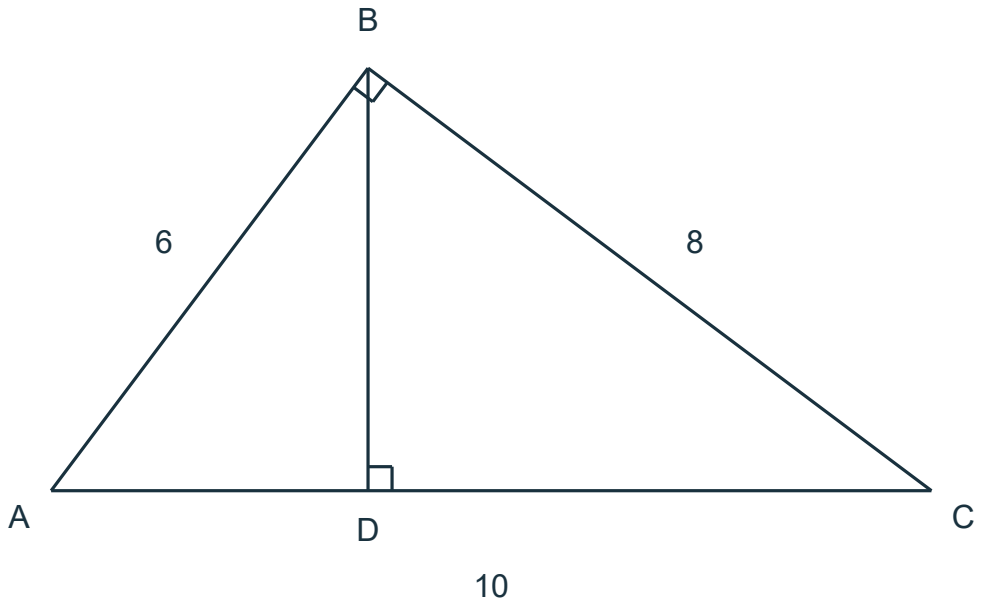


Diagram not drawn to scale.

(a) Find BD.

(b) Find AD.

26. Triangle ABC is right-angled at B. Its side lengths are marked. Give exact fractions for the following.

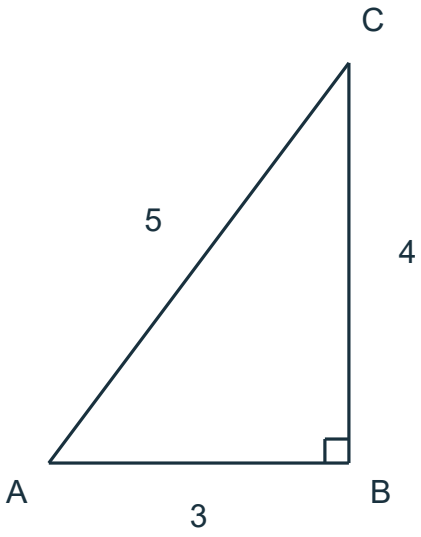


Diagram not drawn to scale.

(a) sin angle BAC

(b) cos angle BAC

(c) tan angle BAC

27. Triangle ABC is right-angled at B. AC = 18 cm and angle BAC = 32°. Find AB and BC to 3 significant figures.

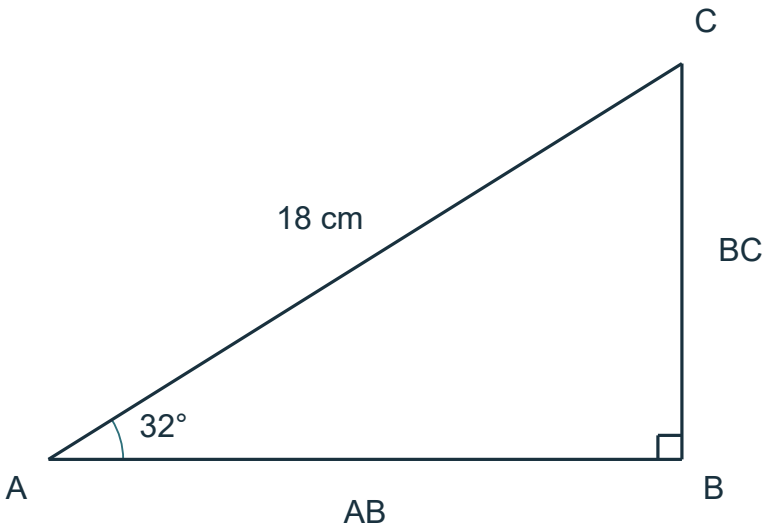


Diagram not drawn to scale.

28. A person observes the top of a vertical tower from a point 24 m from its base. The top is 15 m above the observer's eye level. Find the angle of elevation, to 1 decimal place.

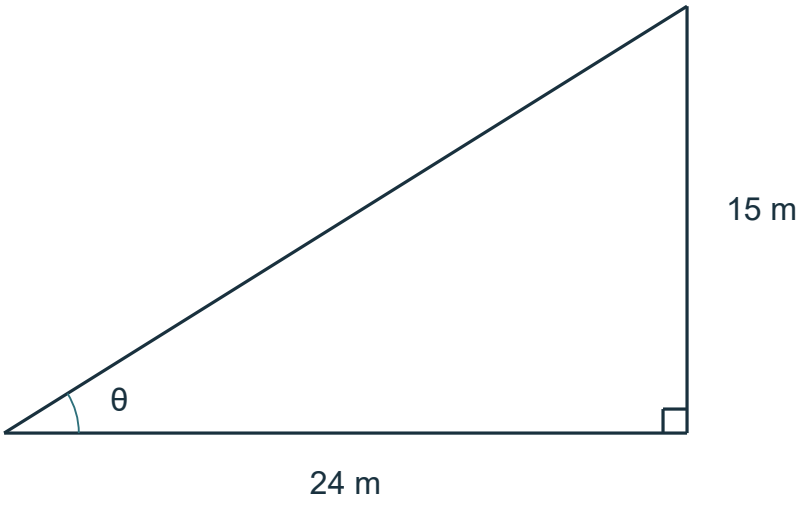


Diagram not drawn to scale.

29. A kite is attached to a taut string of length 120 m, making 35° with horizontal ground. Its ground attachment point is fixed. The kite then moves 35 m farther horizontally from the attachment point, keeping the same height. Give lengths to 3 significant figures and the angle to 1 decimal place.

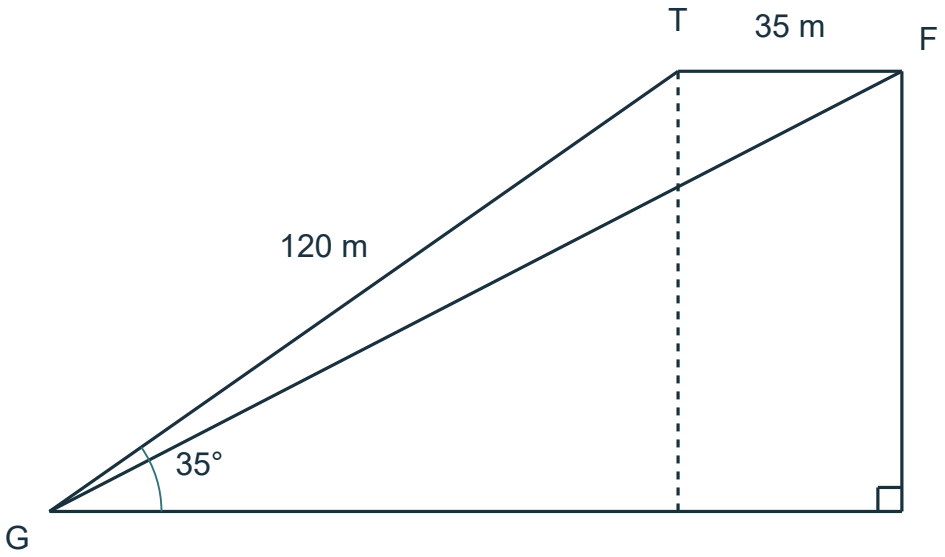


Diagram not drawn to scale.

(a) Find the height of the kite.

(b) Find the new length of taut string.

(c) Find its new angle with the ground.

30. A vertical tower is 30 m tall. Points P and Q lie on level ground on the same side of its base O, with P between O and Q. OP = 18 m and PQ = 25 m. Give angles to 1 decimal place and length to 3 significant figures.

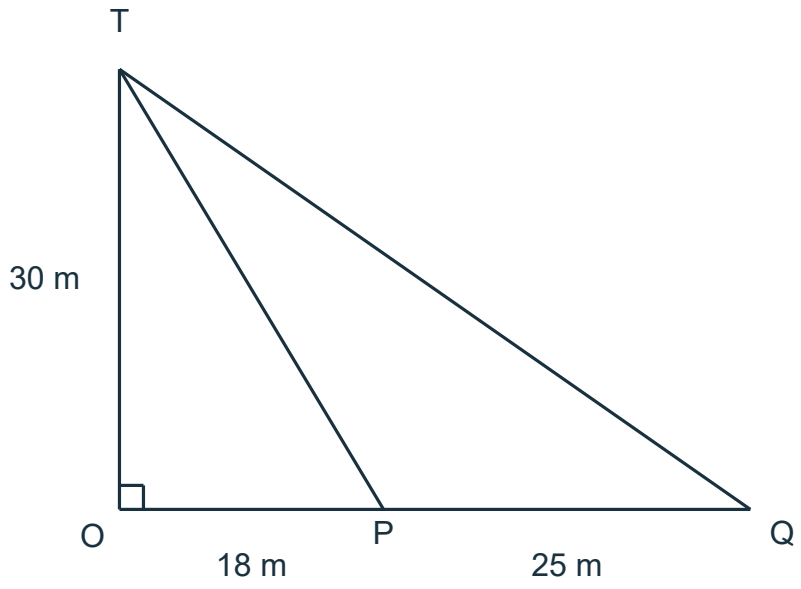


Diagram not drawn to scale.

(a) Find the angle of elevation from P.

(b) Find the angle of elevation from Q.

(c) Find the straight-line distance from Q to the top of the tower.

Final Answers

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

(b) 15

(c) 20

2. (a) $y=\frac{72}{x}$

(b) 9

(c) 8

3. (a) $y=2x^2$

(b) 98

(c) 5

4. (a) $F=3\sqrt{h}$

(b) 27

(c) 36

5. (a) $V=\frac{2}{3}r^3$

(b) 144

(c) 8

6. (a) 72

(b) 2

(c) $\frac{288}{25}$

Final Answers

7. (a) 36 days

(b) 18 workers

8. (a) 10 hours

(b) 120 machine-hours

9. (a) $e=3m$

(b) 33 cm

(c) 6 kg

10. (a) $t=\frac{100}{v}$

(b) $\frac{5}{4}$ hours

(c) $\frac{100}{3}\%$

11. (a) $\frac{3}{2}$

(b) 12 cm

(c) 36 cm

(d) $\frac{9}{4}$

12. 10 cm

3:2 (first : second).

Final Answers

13. (a) 5 cm

(b) 6 cm

(c) $\frac{1}{9}$

14. $\frac{9}{5}$ m

15. (a) 150 m

(b) 7500 m²

16. Yes; SSS; A corresponds to F, B to D, and C to E.

17. Yes; SAS; triangle ABC is congruent to triangle DEF; BC = EF.

18. No. Two sides and a non-included angle do not generally guarantee congruence.

Final Answers

19. (a) QR = 8 cm; AB = 10 cm.

(b) Angle QPR = 72°.

20. (a) 5, 3

(b) 360 cm

21. (a) 15 cm

(b) 54 cm^2

22. (a) First triangle: right-angled, by the converse of Pythagoras' theorem.

(b) Second triangle: not right-angled.

23. (a) 25.0 m

(b) 6.00 m

24. (a) 8.00 m

(b) 2.00 m

Final Answers

25. (a) $\frac{24}{5}$ cm

(b) $\frac{18}{5}$ cm

26. (a) $\frac{4}{5}$

(b) $\frac{3}{5}$

(c) $\frac{4}{3}$

27. AB = 15.3 cm; BC = 9.54 cm.

28. 32.0°

29. (a) 68.8 m

(b) 150 m

(c) 27.3°

30. (a) 59.0°

(b) 34.9°

(c) 52.4 m