

Ready for A Level Maths?

Surds

1. Write these surds in their simplest form.

a) $\sqrt{54}$ b) $\sqrt{24}$ c) $\sqrt{48}$ d) $\sqrt{98}$ e) $\sqrt{112}$ f) $\sqrt{175}$

2. Simplify the following.

a) $\sqrt{2} + \sqrt{2}$ b) $\sqrt{18} + \sqrt{8}$ c) $\sqrt{75} - \sqrt{12}$ d) $3\sqrt{20} + 2\sqrt{45}$

3. Rationalise the denominator and then simplify the following fractions.

a) $\frac{1}{\sqrt{3}}$ b) $\frac{14}{\sqrt{7}}$ c) $\frac{6}{\sqrt{8}}$ d) $\frac{\sqrt{18}}{\sqrt{2}}$ e) $\frac{\sqrt{3}\sqrt{5}}{\sqrt{30}}$

4. Simplify the following.

a) $\sqrt{3} \times \sqrt{3}$ b) $\sqrt{12} \times \sqrt{3}$ c) $\sqrt{8} \times \sqrt{18}$ d) $\sqrt{2}(\sqrt{2} + 1)$

Indices

5. Simplify the following, leaving your answers in index form.

a) $3^5 \times 3^2$ b) $5^6/5^2$ c) Half of 2^{16} d) $(5^2)^3$

6. Simplifying the following, leaving your answers in index form.

a) $9^2 \times 9^{-2}$ b) $2^{-3}/2$ c) $8^{-2} \times 8^{-3}$ d) $7^{-4}/7^{-3}$

7. Find the value of each of the following.

a) $64^{1/2}$ b) $81^{1/4}$ c) $32^{1/5}$ d) $100^{-1/2}$ e) $16^{-1/4}$

f) $1000^{-2/3}$ g) $16^{-3/2}$ h) $32^{-3/5}$ i) $125^{-2/3}$

8. Evaluate the following.

a) $(\sqrt{5})^4$ b) $27^{2/3}$ c) $128^{-5/7}$ d) $125^{-2/3}$

9. Find the value of x in each of these.

a) ${}^x\sqrt{27} = 3$ b) ${}^x\sqrt{16} = 2$ c) ${}^x\sqrt{32} = 2$ d) $25^x = 5$ e) $27^x = 9$

Algebra

10. Simplify the following expressions

a) $3d^2 \times 2d^2$ b) $a^2b \times ba^2$ c) $2r^2s \times 5r^3s^2$ d) $(mn^2)^3$

11. Simplify the following by cancelling, where possible.

a) $\frac{t^3}{t^2}$ b) $\frac{2uv}{u}$ c) $\frac{12p^2}{3p}$ d) $\frac{a^2bc^3}{2ab}$ e) $\frac{3ab}{2ac} \times \frac{4bc}{6b^2}$

12. Expand (multiply out) the following brackets

a) $(x + 8)(x - 2)$ b) $(x + 5)(x - 2)$ c) $(2x + 1)(x + 3)$

d) $(3x - 1)(2x + 5)$ e) $(4x - 2)(3x + 5)$ f) $(x - 7)^2$

13. Solve the following equations by factorising.

a) $x^2 - 3x + 2 = 0$ b) $x^2 - 49 = 0$ c) $x^2 + 6x = 0$

d) $2x^2 + 7x + 5 = 0$ e) $6a^2 + 3a - 63 = 0$

f) $x^2 = 2x + 15$ g) $8x^2 = 3 - 2x$

14. Change these quadratic expressions into the form $(ax + b)^2 + c$

a) $4x^2 + 16x + 5$ b) $16x^2 - 40x + 9$ c) $100x^2 + 60x + 3$

15. By completing the square, find the minimum value of the expression $x^2 - 10x + 26$

16. Solve by completing the square, giving exact answers (ie in surd form) $2x^2 - 4x - 5 = 0$

17. Use the quadratic formula to solve the following equations.

a) $x^2 + 4x + 3 = 0$ b) $2x^2 + x - 3 = 0$ c) $5x^2 + 2x - 3 = 0$

18. Solve the following pairs of simultaneous equations

a) $2x + y = 7$ b) $5x - 2y = 13$ c) $x - 3y = 8$
 $x + y = 4$ $3x + 2y = 3$ $x + 2y = -7$

$$\begin{aligned} \text{d) } y &= x^2 + 2 \\ y + 3x &= 0 \end{aligned}$$

$$\begin{aligned} \text{e) } x^2 + y^2 &= 20 \\ x &= 2y \end{aligned}$$

$$\begin{aligned} \text{f) } 4y + x &= 3 \\ x + 2/y &= 1 \end{aligned}$$

Graphs

19. A straight line has equation $x + 2y = 6$, state the coordinates of the points where the line crosses the axes.

20. Which of the following lines are perpendicular to the line $y = x$?

a) $y = 1/2x$ b) $y = -x$ c) $x + y = 3$ d) $y = x - 1$

21. Find the equation of the line perpendicular to $y = x$ which passes through the point $(0, 2)$

22. Given the points L $(-2, -1)$, M $(0, 5)$ and N $(4, -2)$,

- a) Find the equation of the line through N and parallel to LM
b) Find the equation of the line through N and perpendicular to LM

Curve sketching

23.

- a) Draw the graph of $y = x^2 - 2$ for values of x from -3 to 3
b) Draw the graph of $y = x^2 - x + 2$ for values of x from -2 to 3
c) Draw the graph of $y = 2x - x^2$ for values of x from -1 to 3

24.

- a) Sketch the sine function for values of x from 0° to 360°
b) Sketch the cosine function for values of x from 0° to 360°
c) c) Sketch the tangent function for values of x from 0° to 360°

25. Sketch the graph of $y = x^{-1}$ for values of x from -4 to 4

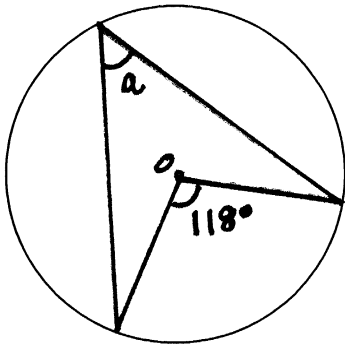
26. Sketch the graph of $y = x^3$

Circle properties

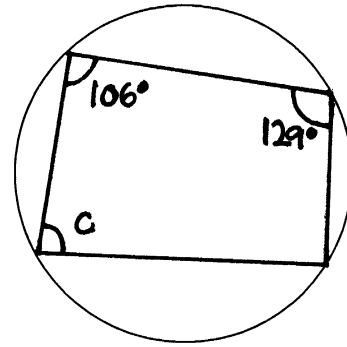
Please note, diagrams are not drawn accurately. Angles must be calculated not measured!

27. O is the centre of the circle. Work out the size of the marked angles, giving your reasons.

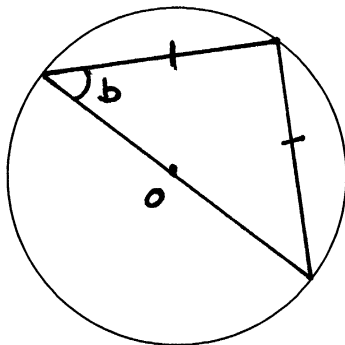
a)



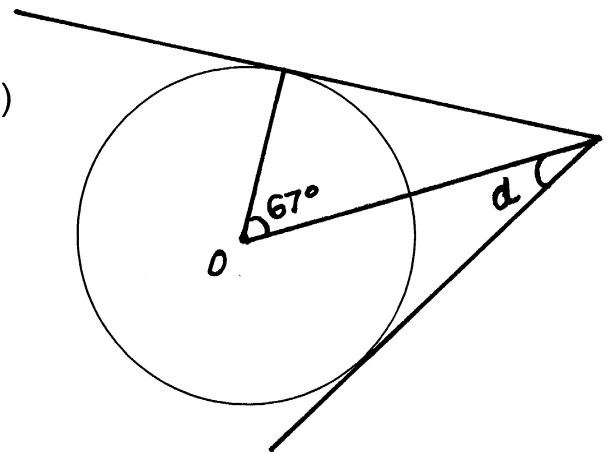
c)



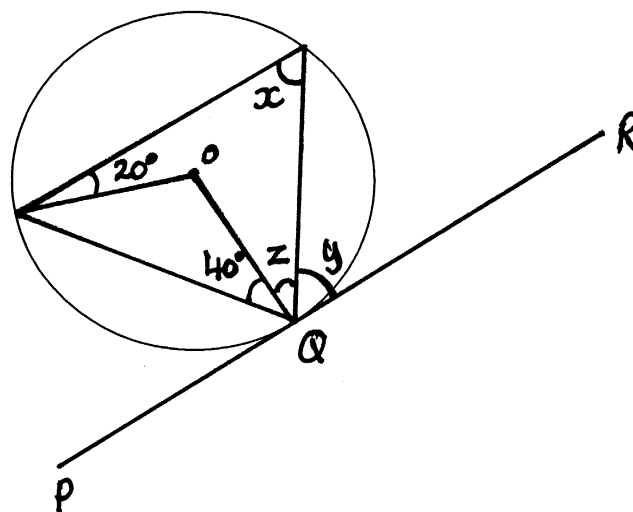
b)



d)

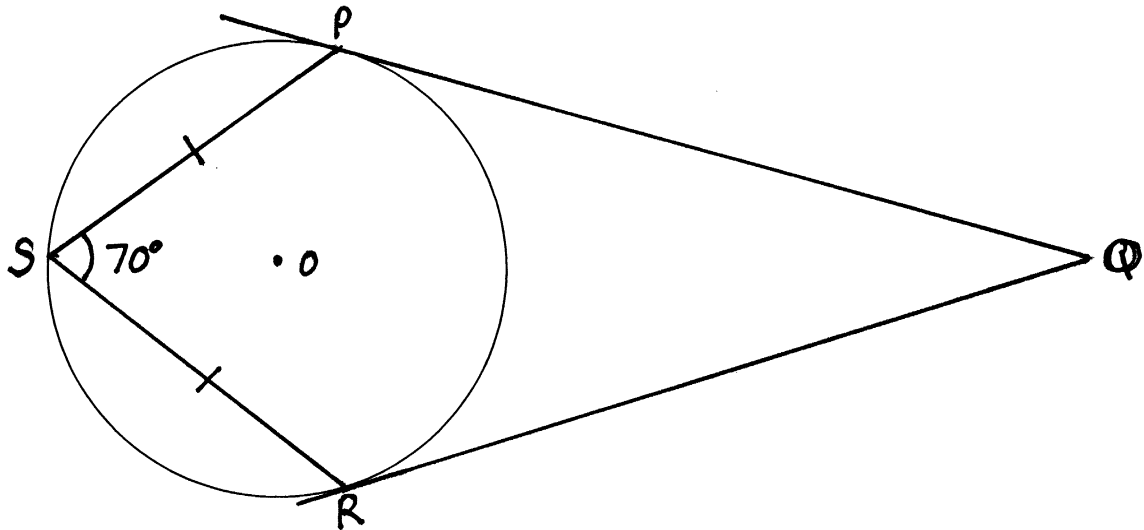


28. In the diagram, O is the centre of the circle and PQR is a tangent to the circle. Calculate the sizes of the angles marked.



29. The diagram shows a circle centre O . PQ and QR are tangents to the circle at P and Q respectively. S is a point on the circumference of the circle.

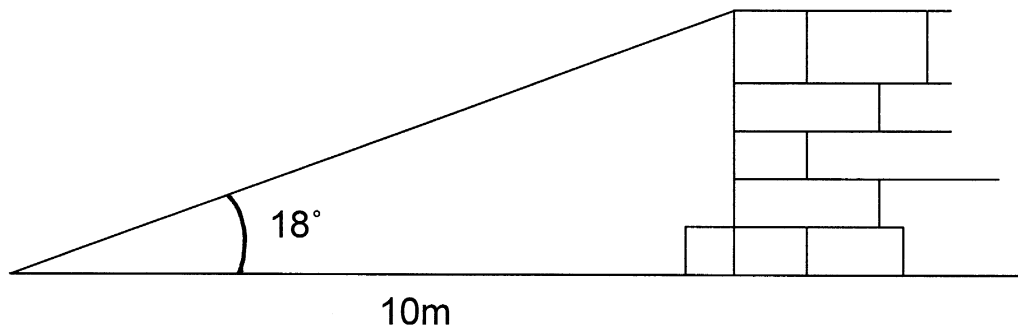
- Calculate the size of angle PQR , giving the reason(s) for your answer.
- Calculate the size of angle SPO .
- Explain why $PQRS$ cannot be a cyclic quadrilateral.



Trigonometry

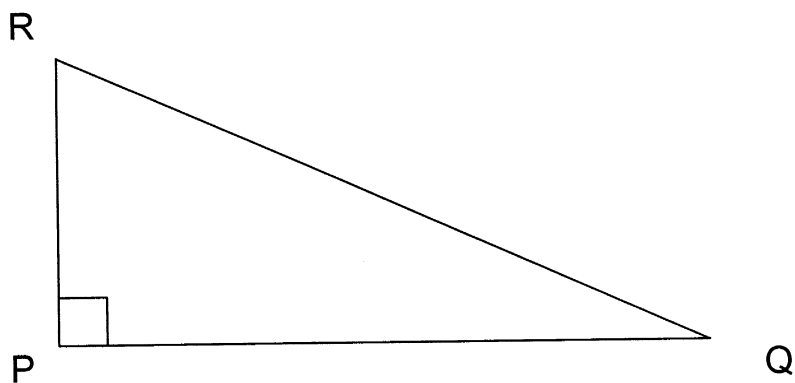
Sketches are not accurate. Calculate, do not measure lengths or angles.

30.



At a distance of 10m from a wall, the angle of elevation from the ground to the top of the wall is 18° . Calculate the height of the wall.

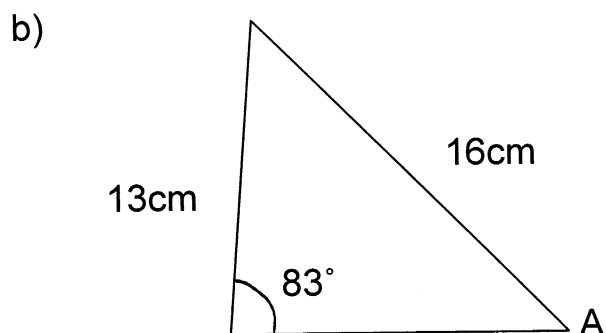
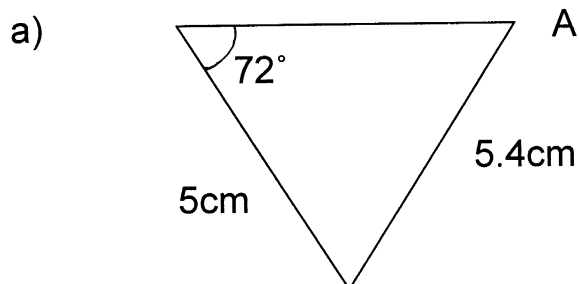
31.



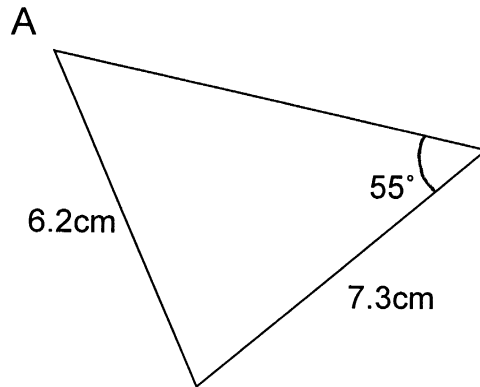
$\cos PQR = 12/13$

- a) Find $\tan PQR$
- b) Find $\sin PQR$
- c) If PQ is 6cm, what are the lengths of QR and PR?

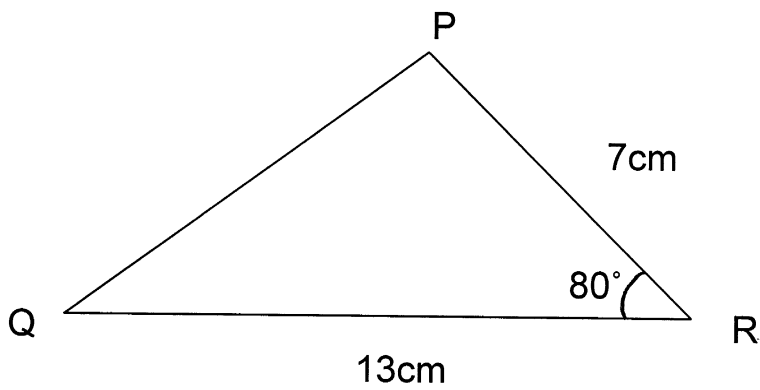
32. Calculate angle A in each of these acute-angled triangles.



c)

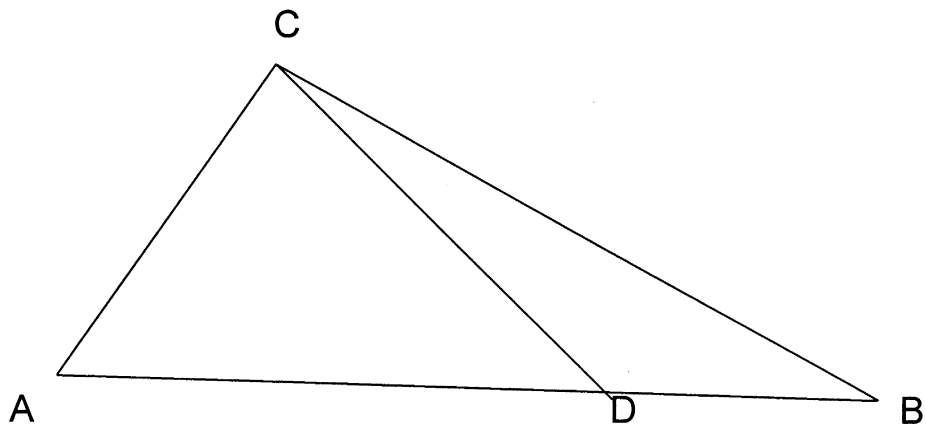


33.



- a) Calculate the length of PQ
- b) Calculate the size of angle QPR

34.

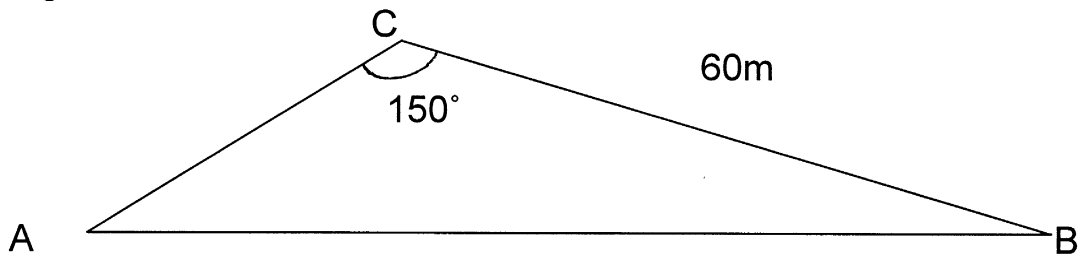


$$AC = 18\text{cm} \quad CD = 23\text{cm} \quad CB = 29\text{cm} \quad AB = 38\text{cm}$$

- Work out the size of angle BAC
- Calculate the size of angle ADC

35.

The area of triangle ABC is 450m^2 . Calculate the perimeter of triangle ABC .



Sequences

36. Find the next three terms in the following sequences.

- a) 6, 8, 10, 12, ... b) 3, 6, 12, 24, ... c) 80, 40, 20, 10, ...

37. Find the n th term of the following sequences.

- a) 5, 9, 13, 17, ... b) 6, 4, 2, 0, ... c) 3, 8, 13, 18, ...
d) 3, 6, 11, 18, ... e) 49, 46, 41, 34, ... f) $-2, 1, 6, 13, \dots$