NCEA Level 2 · AS 91259: Trig: Rules, Bearings & Radians

Name: Date:

Kia ora! This standard is about picking the right trig tool, sine rule, cosine rule, area formula, or radian measure, and using it to crack real problems, including bearings and 3D. Work through each section in order; the answers show the full working a marker wants to see.

Revision summary

- Sine rule: $a/\sin A = b/\sin B = c/\sin C$. Use when you have a side–opposite-angle pair (find a side or an angle).
- Cosine rule: $c^2 = a^2 + b^2 - 2ab\cdot\cos C$. Use for SAS (find a side) or SSS (rearrange: $\cos C = (a^2+b^2-c^2)/(2ab)$ to find an angle).
- Area of a triangle = $\frac{1}{2}\, ab\cdot\sin C$ (two sides and the included angle). Heron's: Area = $\sqrt{(s(s-a)(s-b)(s-c))}$, $s = (a+b+c)/2$.
- Bearings are measured clockwise from north, written as three digits (e.g. 072°). Sketch a north line at each point and find the interior angle before applying a rule.
- Radians: $180° = \pi$ rad. Convert: degrees $\times \pi/180$ = radians; radians $\times 180/\pi$ = degrees.
- Arc length $L = r\theta$ and sector area $A = \frac{1}{2}r^2\theta$, with θ in radians.
- Segment area = $\frac{1}{2}r^2(\theta - \sin\theta)$; chord length = $2r\cdot\sin(\theta/2)$, θ in radians.
- Ambiguous case (SSA): $\sin B = b\cdot\sin A/a$ may give two answers (B and 180°−B), check each keeps $A+B < 180°$.

Key skills

1. In triangle ABC, angle A = 40°, angle B = 65° and side a = 12 cm. Find side b.

2. Two sides of a triangle are 8 m and 11 m with an included angle of 52°. Find the third side.

3. A triangle has sides 9 cm and 14 cm with an included angle of 38°. Find its area.

4. A sector has radius 10 cm and central angle 1.2 radians. Find the arc length and the sector area.

Achieved

5. A tramper leaves the hut and walks 8 km on a bearing of 120°. How far south of the hut is she?

6. In triangle ABC, side a = 15 cm is opposite angle A, and side b = 10 cm is opposite angle B = 35°. Find angle A.

7. A triangular paddock has sides 7 m, 9 m and 12 m. Find the size of its largest angle.

8. An arc of a circle of radius 6 cm has length 15 cm. Find the central angle in radians, then in degrees.

Merit

9. A yacht sails 12 km on a bearing of 050°, then turns and sails 8 km on a bearing of 140°. Find its straight-line distance from the start, and the bearing it must steer to return directly to the start.

10. A triangular garden has sides 18 m, 22 m and 26 m. Find its area.

11. In triangle ABC, side a = 9 cm is opposite angle A = 40°, and side b = 12 cm is opposite angle B. Show that there are two possible triangles and find both values of B.

Excellence

12. From point A on flat ground the angle of elevation to the top of a flagpole is 28°. Walking 40 m directly toward the base to point B, the angle of elevation becomes 45°. Find the height of the flagpole, justifying your method.

13. Prove that the area of any triangle can be written as Area = $(a^2 \cdot \sin B \cdot \sin C)/(2 \cdot \sin A)$, where a, b, c are sides opposite angles A, B, C.

14. A circle has radius 8 cm. A chord of the circle is 10 cm long. Find the area of the minor segment cut off by the chord.