Topic Test: Applications of Trigonometry
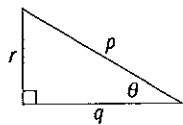
Remember: these are HSC-type questions.

Part A
(Suggested time: 15 minutes)

Choose the correct answer (A, B, C or D)
for each question.　　　　　　One mark each

1 Referring to the diagram, which statement is correct?

A $\sin \theta = \dfrac{p}{r}$ 　　　　 B $\cos \theta = \dfrac{r}{p}$

C $\tan \theta = \dfrac{q}{r}$ 　　　　 D none of these
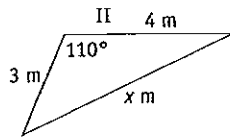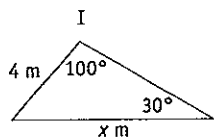
2 $\cos \theta = ?$

5 m　8 m　7 m

A $\dfrac{1}{7}$ 　　 B $\dfrac{5}{8}$ 　　 C $\dfrac{1}{2}$ 　　 D $\dfrac{11}{14}$

3 In order to find the value of x in each of these triangles, which rule should be used?

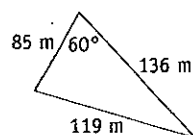I　4 m　100°　30°　x m

II　4 m　110°　3 m　x m

A sine rule in both
B sine rule in I, cosine rule in II
C cosine rule in I, sine rule in II
D cosine rule in both

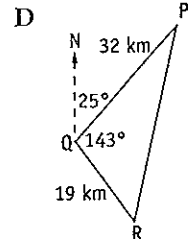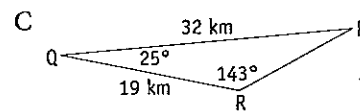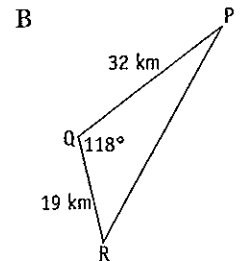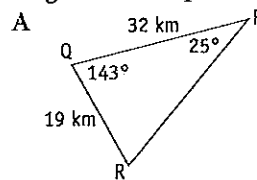**4** Find the area of the paddock to the nearest square metre.

85 m　60°　136 m　119 m
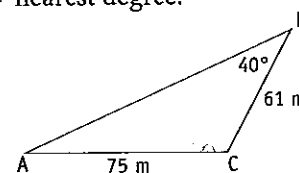
A 2890 m²　　　　 B 7008 m²
C 5006 m²　　　　 D 4380 m²

5 Town P is 32 km from Q on a bearing of 025°. Town R is 19 km from Q on a bearing of 143°. Which diagram best represents this information?

A　32 km　P　25°　Q　143°　19 km　R

B　P　32 km　Q 118°　19 km　R

C　32 km　P　Q　25°　143°　19 km　R

D　N　32 km　P　25°　Q　143°　19 km　R

6 Use the sine rule to find the size of angle A to the nearest degree.
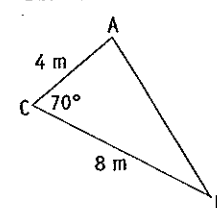
B　40°　61 m　A　75 m　C

A 54°　　　　　　 B 52°
C 32°　　　　　　 D 27°

7 Use the cosine rule to find the length of side AB. Give the answer correct to one decimal place.
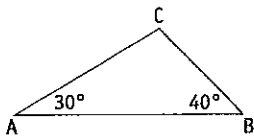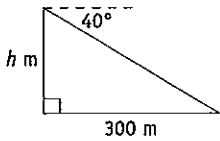
A　4 m　C 70°　8 m　B

A 7.6 m　　　　　 B 5.5 m
C 10.1 m　　　　　 D 2.3 m

8 B is due east of A. $\angle CAB = 30°$ and $\angle CBA = 40°$. What is the bearing of B from C?

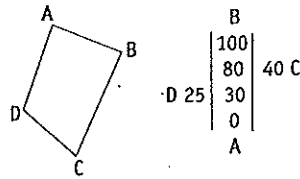| A 110°	B 120°
C 130°	D 140°.

9 From the top of a building, the angle of depression of an object on the ground, 300 metres from the base of the building on level ground, is 40°. Which expression will find the height (h m) of the building?

A 300 tan 40°   B 300 tan 50°

C $\dfrac{300}{\tan 40°}$ D $\dfrac{\tan 50°}{300}$

10 A block of land has been surveyed and a rough sketch and notebook entries are given. What is the area of the land?
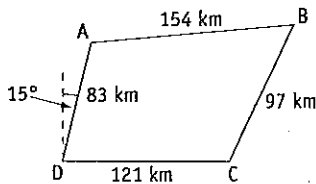

A 1975 m²	B 3250 m²
C 3950 m²	D 5225 m²


Part B

(Suggested time: 25 minutes)

Show all working.

15 marks

---

11 A, B, C and D are four towns. A is 83 km from D on a bearing of 015° and D is 121 km due west of C. B is 154 km from A and 97 km from C.

a Find the size of $\angle$ADC.   1 mark

b Use the cosine rule in $\triangle$ADC to find the distance from A to C to the nearest kilometre.   2 marks

c Find the size of $\angle$ABC to the nearest degree.   2 marks

12 A compass radial survey has been completed of a block of land.
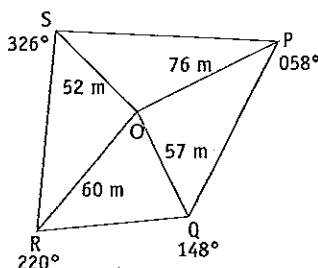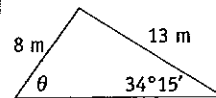

a Explain why $\triangle$OPQ is a right-angled triangle.   1 mark

b Find the length of PQ.   1 mark

c Find the size of $\angle$SOP.   1 mark

d Find the area of $\triangle$SOP.   1 mark

13 A plane leaves A and flies on a bearing of 125° to B, a distance of 320 km. From B it flies on a bearing of 205° to C, which is due south of A.

a Draw a diagram showing the path of the plane.   1 mark

b What is the size of angle ABC?   1 mark

c Find the distance from B to C to the nearest kilometre.   2 marks
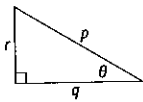
14 Find θ to the nearest minute.

2 marks

4

$A = \dfrac{1}{2}ab\sin C$

$\quad = \dfrac{1}{2} \times 85 \times 136 \times \sin 60°$

$\quad = 5005.626\,834\ldots$

$\quad = 5006 \quad$ (nearest unit)

The area of the triangle is 5006 m^2,
to the nearest square metre. **C**

5

$\angle PQR = 143° - 25°$

$\qquad\quad = 118°$ **B**

6

$\dfrac{\sin A}{a} = \dfrac{\sin B}{b}$

$\dfrac{\sin A}{61} = \dfrac{\sin 40°}{75}$

$\sin A = \dfrac{61 \sin 40°}{75}$

$\angle A = 31.520\,297\,67\ldots°$

$\qquad = 32° \quad$ (nearest degree) **C**

7

$c^2 = a^2 + b^2 - 2ab\cos C$

$\quad = 8^2 + 4^2 - 2 \times 8 \times 4 \times \cos 70°$

$\quad = 58.110\,710\,83\ldots$

$c = \sqrt{58.110\,710\,83\ldots} \quad (c > 0)$

$\quad = 7.623\,038\,163\ldots$

$\quad = 7.6 \quad$ (1 d.p.)

The length of AB is 7.6 metres,
to one decimal place. **A**

8

Let X be a point due north of C
and let Y be a point due north of B.

$\angle YBA = 90° \quad$ (A is due west of B)

$\angle YBC = 90° - 40°$

$\qquad\quad = 50°$

$\angle XCB + \angle YBC = 180°$ (co-interior $\angle$s,
$\qquad\qquad\qquad\qquad\qquad$ parallel lines)

$\angle XCB = 180° - 50°$

$\qquad\quad = 130°$

The bearing of B from C is 130°. **C**

9

$\angle PQR = \angle SPQ \quad$ (alternate angles,
$\qquad\qquad\qquad\qquad$ parallel lines)

$\angle PQR = 40°$

$\tan 40° = \dfrac{h}{300}$

$\quad h = 300 \tan 40°$ **A**

10

$A = \dfrac{1}{2} \times 100 \times 40 + \dfrac{1}{2} \times 100 \times 25$

$\quad = 3250$

The area of the land is 3250 m^2. **B**

11

a C is due east of D

$\angle ADC = 90° - 15°$

$\qquad\quad = 75°$ ✓

b $d^2 = a^2 + c^2 - 2ac\cos D$

$\quad = 121^2 + 83^2$

$\qquad - 2 \times 121 \times 83 \times \cos 75°$ ✓

$\quad = 16\,331.360\,66\ldots$

$d = \sqrt{16\,331.360\,66\ldots} \quad (d > 0)$

$\quad = 127.794\,2122\ldots$

$\quad = 128 \quad$ (nearest unit)

The distance from A to C is
128 km, to the nearest kilometre. ✓

c In $\triangle ABC$,

$\cos B = \dfrac{a^2 + c^2 - b^2}{2ac}$

$\qquad = \dfrac{97^2 + 154^2 - (127.79\ldots)^2}{2 \times 97 \times 154}$ ✓

$\angle B = 55.798\,060\,71\ldots°$

$\qquad = 56° \quad$ (nearest degree)

$\angle ABC = 56°$ to the nearest degree. ✓

12

a $\angle POQ = 148° - 58°$

$\qquad\quad = 90°$

$\therefore \triangle OPQ$ is right-angled at O. ✓

Topic Test p161
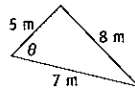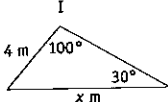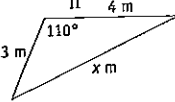
1

$\sin \theta = \dfrac{r}{p}$

$\cos \theta = \dfrac{q}{p}$

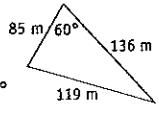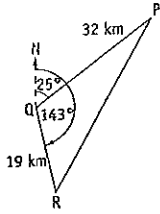$\tan \theta = \dfrac{r}{q}$

None are correct. **D**

2

$\cos C = \dfrac{a^2 + b^2 - c^2}{2ab}$

$\cos \theta = \dfrac{5^2 + 7^2 - 8^2}{2 \times 5 \times 7}$
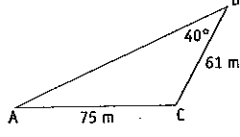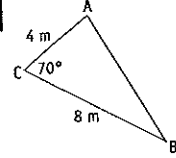
$\quad = \dfrac{10}{70}$

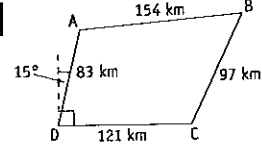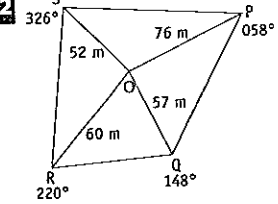$\quad = \dfrac{1}{7}$ **A**

3

sine rule in I; cosine rule in II **B**

---

b $PQ^2 = 76^2 + 57^2$

$\qquad = 9025$

$\qquad PQ = \sqrt{9025} \quad (PQ > 0)$

$\qquad\qquad = 95$

The length of PQ is 95 metres. ✓

c $\angle SOP = (360 - 326)° + 58°$

$\qquad\qquad = 92°$ ✓

d $A = \dfrac{1}{2} ps \sin O$

$\qquad = \dfrac{1}{2} \times 52 \times 76 \times \sin 92°$

$\qquad = 1974.796\,274\ ...$

$\qquad = 1975 \quad \text{(nearest unit)}$

The area of triangle SOP is 1975 m², to the nearest square metre. ✓

13 a
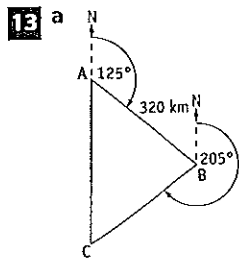
b Let X be a point due north of A and let Y be a point due north of B.

$\angle XAB + \angle ABY = 180° \quad$ (co-int. $\angle$s, parallel lines)

$\qquad\quad \angle ABY = 180° - 125°$

$\qquad\qquad\qquad = 55°$

$\angle ABC + 205° + 55° = 360° \quad$ (angles at a point)

$\qquad\quad \angle ABC = 360° - 260°$

$\qquad\qquad\qquad = 100°$ ✓

c $\angle BAC = 180° - 125° \quad$ (C is south of A)

$\qquad\qquad = 55°$

$\angle BCA + 55° + 100° = 180° \quad$ (angle sum of $\triangle$)

$\qquad\quad \angle BCA = 180° - 155°$

$\qquad\quad \angle BCA = 25°$ ✓

$\dfrac{a}{\sin A} = \dfrac{c}{\sin C}$

$\dfrac{a}{\sin 55°} = \dfrac{320}{\sin 25°}$

$\qquad a = \dfrac{320 \sin 55°}{\sin 25°}$

$\qquad\quad = 620.249\,2365\ ...$

$\qquad\quad = 620 \quad \text{(nearest unit)}$

The distance from B to C is 620 km, to the nearest kilometre. ✓

14 $\dfrac{\sin A}{a} = \dfrac{\sin B}{b}$

$\dfrac{\sin \theta}{13} = \dfrac{\sin 34°15'}{8}$

$\sin \theta = \dfrac{13 \sin 34°15'}{8}$ ✓

$\qquad \theta = 66.143\,036\,04\ ...°$

$\qquad\quad = 66° 9' \quad \text{(nearest minute)}$ ✓