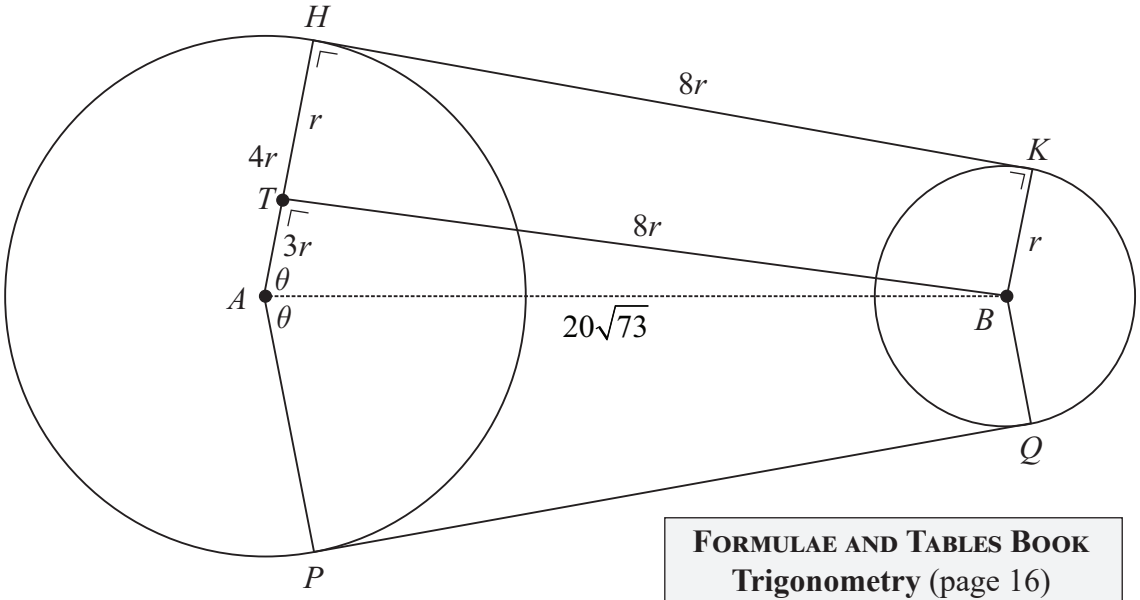
LC 2015: Paper 2

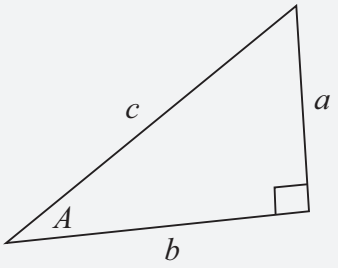
Question 7 (40 marks)

Question 7 (a)

Note: You can see from the measurements on the diagram that it is not obviously drawn to scale. To draw it to scale would make the smaller circle tiny making it difficult to see measurements.



Formulae and Tables Book
Trigonometry (page 16)
Pythagoras' theorem



$c^2 = a^2 + b^2$

Consider the right-angled triangle ATB.
Apply Pythagoras.

$(3r)^2 + (8r)^2 = (20\sqrt{73})^2$

$9r^2 + 64r^2 = 400 \times 73$

$73r^2 = 400 \times 73$

$r^2 = 400$

$\therefore r = \sqrt{400} = 20$ cm

Marking Scheme Notes
Question 7 (a) [Scale 15C (0, 5, 12, 15)]
5: • BT drawn correctly
• Pythagoras formula with some correct substitution
• Recognising $|\angle ATB| = 90°$
12: • Pythagoras formula fully substituted

Question 7 (b)

Area of quadrilateral $ABKH$ = Area of rectangle $TBKH$ + Area of right-angled triangle ABT

$\text{Area} = (8r)(r) + \frac{1}{2}(3r)(8r) = 8r^2 + 12r^2 = 20r^2 = 20(20)^2 = 8000 \text{ cm}^2$

Marking Scheme Notes
Question 7 (b) [Scale 15C (0, 5, 12, 15)]
5: • Indicates two areas
• Effort at area of rectangle only
• Effort at area of triangle only
12: • Area of triangle correct
• Area of rectangle correct

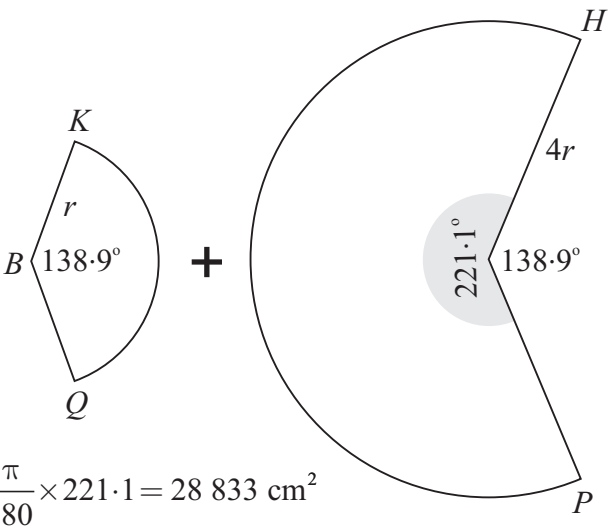
Question 7 (c) (i)

$$\tan\theta = \frac{8r}{3r} = \frac{8}{3} \Rightarrow \theta = \tan^{-1}\left(\frac{8}{3}\right) = 69\cdot44^{\circ}$$

$$|\angle HAP| = 2\theta = 138\cdot9^{\circ}$$

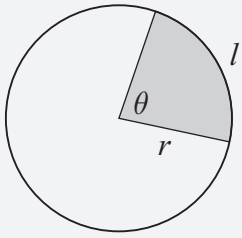
Marking Scheme Notes
Question 7 (c) (i) [Scale 5C (0, 2, 4, 5)]
2: • $\tan(\angle HAB) = \frac{160}{60}$ or equivalent in sin or cos
4: • $|\angle HAB|$ in degrees

Question 7 (c) (ii)

Total area of machine part = 2(Area of $ABKH$) + 

$$\text{Area} = 2(8000) + \tfrac{1}{2}(20)^2 \times \frac{\pi}{180} \times 138\cdot9 + \tfrac{1}{2}(80)^2 \times \frac{\pi}{180} \times 221\cdot1 = 28\ 833\ \text{cm}^2$$

Formulae and Tables Book
Length and area:
Arc/sector [page 8]



$l = r\theta$
$A = \frac{1}{2}r^2\theta$
when θ is in radians.

Degrees to radians: $\times \frac{\pi}{180^{\circ}}$

Radians to degrees: $\times \frac{180^{\circ}}{\pi}$

Marking Scheme Notes
Question 7 (c) (ii) [Scale 5C (0, 2, 3, 4, 5)]
2: • Effort at area of one region
3: • Area of one sector with correct substitution
4: • Area of two sectors with substitution correct in both