Circles Past Paper Questions - Solutions

(1) 2010 Paper 2 Q6

Key words: radius, angle, length of arc.

units: cm, °.

Formulae:

Arc length = Fraction of circumference

Arc length = $\frac{\text{angle}}{360} \times \pi d$ ✓

Arc length = $\frac{140}{360} \times \pi \times 72$ ✓

(3KU)

Arc length = 87.96 cm ✓ (any rounding)

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(2) 2009 Paper 2 Q.11

Key words: sector, radius, angle, area, circumference.

Units / Information: angle = 100°, r = 30cm,

Formulae:

(a) Area of sector = fraction × Area of circle

Area of sector = $\frac{\text{Angle}}{360} \times \pi r^2$ ✓

Area of sector = $\frac{260}{360} \times \pi \times 30^2$ ✓

(3KU)

Area of Paper = 2042.04 cm^2 ✓ (any rounding)

(b) Circumference of base = arc length of sector ✓

circumference = $\frac{\text{angle}}{360} \times \pi d$

circumference = $\frac{260}{360} \times \pi \times 60$ ✓

(3RE)

circumference = 136.14cm ✓ (any rounding)

(3) 2008 Paper 2 Q.8

- key words: arc, angle.
- units/information: arc length = 120cm.
- Formulae: Arc length = fraction of circumference.

(a) Angle = $360 \div 12 \times 5$ ($\frac{5}{12}$ of 360°)

Angle = 150° ✓ (1 KU)

(b) length of clock hand = radius of circle.

Arc length = $\frac{\text{angle}}{360^\circ} \times \pi d$

$120 = \frac{150}{360} \times \pi \times d$ ✓

$d = 120 \times 360 \div 150 \div \pi$ ✓

$d = 91.67\text{cm}$ ✓ (4RE)

radius = $91.67 \div 2 = 45.8\text{cm}$ ✓

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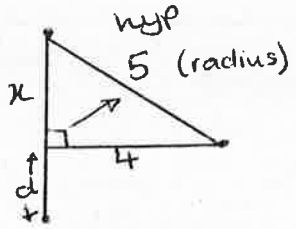
(4) 2007 Paper 1 Q.12

- Key Words: cross-section, semi-circle, diameter, depth.
- units/information: d = 10cm, width of water surface = 8cm.
- Formulae: ?
- Diagram shows chord => symmetry => right-angled triangle.



By Pythagoras:

$x^2 = 5^2 - 4^2$ ✓

$x^2 = 9$

$x = 3$ ✓

$d = 5 - 3$ ✓ (radius - 3). (4RE)

depth = 2cm ✓

(5) 2007 Paper 2 Q.7

- Key words: identical, sector, radius, angle, total, area.
- Units / Information: $r = 5cm$, angle $= 64°$.
- Formulae:
  - Area of sector = fraction × area of circle

$$\text{Area of sector} = \frac{\text{angle}}{360°} \times \pi r^2$$

$$\text{Area of sector} = \frac{64}{360} \times \pi \times 5^2 \quad \checkmark$$

$$\text{Area of sector} = 13.96 \quad \checkmark$$

- Total area of plastic $= 13.96 \times 4$ (3RU)

$$\text{Area} = 55.9\ cm^2 \quad \checkmark$$

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(6) 2006 Paper 2 Q.8

- Key words: circular, ponter = radius, arc, angle, weight
- Units / Information: ponter = 9cm, 100g ⇒ arc of 2cm. angle $= 284°$.
- Formulae:

$$\text{Arc length} = \text{fraction} \times \text{circumference}$$

$$\text{Arc length} = \frac{\text{angle}}{360} \times \pi d$$

$$\text{Arc length} = \frac{284}{360} \times \pi \times 18 \quad \checkmark$$

$$\text{Arc length} = 44.6\ cm. \quad \checkmark$$ (4RE)

- Weight of Parcel $= 44.6 \div 2 \times 100$ ✓

$$\text{Weight} = 2230.5\ g. \quad \checkmark$$

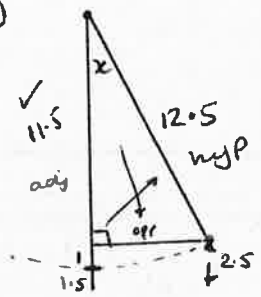
(7) 2005 Paper 2 Q.10

Key words: vertical, maximum height, angle, length of arc, significant figures.

Units / Information: radius (chain) = 12.5m, all lengths m.

Formulae: length of arc = fraction of circumference.

(a)



SOH / CAH / TOA ✓

$\cos(\text{angle}) = \frac{\text{adj}}{\text{hyp}}$ ✓(method)

$\cos x = \frac{11.5}{12.5}$ ✓

$x = \cos^{-1}(11.5 \div 12.5)$ ✓ (4RE)

$x = 23°$

(b) Arc length $= \frac{\text{angle}}{360} \times \pi d$

Arc length $= \frac{46}{360} \times \pi \times 25$ ✓ (4RE)

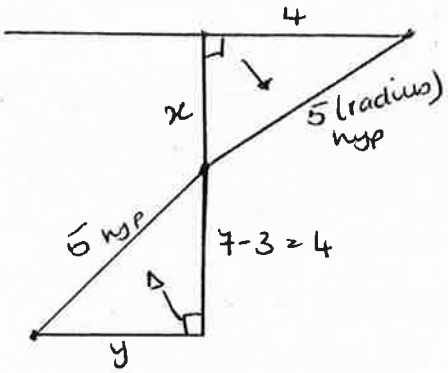
Arc length = 10.036 cm ✓

Arc length = 10.0 cm (3 sig figs) ✓

Note: If you can't do (a) you can still do (b).

(8) 2005 Paper 1 Q. 10

- Key words: radius, circle, segments, parallel, width.
- Units / Information: r = 5cm, lengths in cm.
- Formulae: segments ⇒ symmetry ⇒ right-angled △ ⇒ Pythagoras



$x^2 = 5^2 - 4^2$ ✓

$x^2 = 9$

$x = 3$ ✓

$y^2 = 5^2 - 4^2$

$y^2 = 25 - 16$ ✓

$y^2 = 9$

$y = 3$. ✓

5RE

- Width of base = 3 × 2 = 6cm ✓

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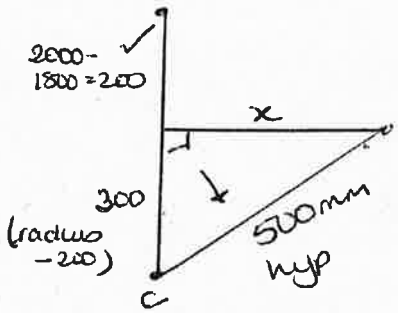
(9) 2004 Paper 2 Q. 8

- Key words: arc of circle, radius, height, vertical edge, width.
- Units / Information: r = 500mm, all lengths mm.
- Formulae: ? Diagram shows segment / chord ⇒ symmetry ⇒ right-angled △ ⇒ Pythagoras.



$x^2 = 500^2 - 300^2$ ✓ (Pythagoras)

x^2 160000

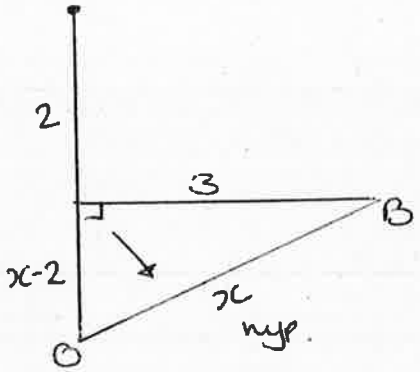
$x = 400$ ✓

5RE

- Width of doorway = 800mm ✓

(10) 2003 Paper 2 Q.10

- Key words: cylinder, cross-section, segment, radius, length
- units/Information: 6m wide, 2m high.
- formulae: segment ⇒ symmetry ⇒ right-angled △ ⇒ Pythagoras.



- calculate OB = radius
- let OB = x.

By Pythagoras: ✓

$x^2 = (x-2)^2 + 3^2$ ✓

$x^2 = x^2 - 4x + 4 + 9$

$x^2 = x^2 - 4x + 13$

$4x = 13$ ✓

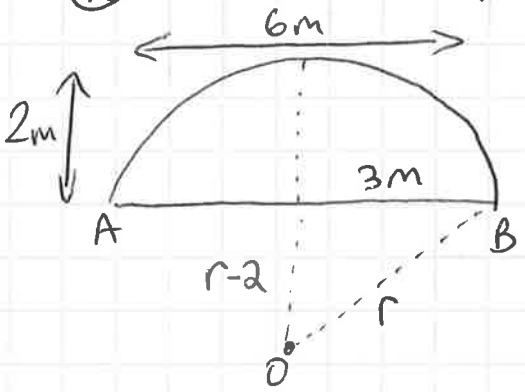
$x = 13/4$

$x = 3\frac{1}{4}$ m.

✓

Length of OB = 3·25 m. (4RE)

(10) 2003 Paper 2 Q10.



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

$r^2 = (r-2)^2 + 3^2$

$r^2 = (r-2)(r-2) + 9$

$r^2 = r^2 - 4r + 4 + 9$

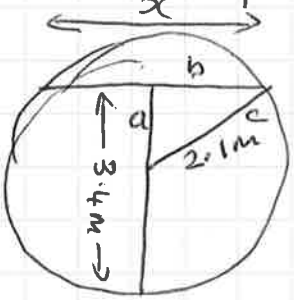
$r^2 - r^2 + 4r = 13$

$4r = 13$

$r = \frac{13}{4} = 3.25\text{m}.$

(11) 2002 Paper 2 Q6.

a)



$a = 3.4 - 2.1 = 1.3\text{m}.$

$b = \frac{x}{2}.$

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

$2.1^2 = 1.3^2 + (\frac{x}{2})^2$

$4.41 = 1.69 + \frac{x^2}{4}$

$\frac{x^2}{4} = 4.41 - 1.69$

$\frac{x^2}{4} = 2.72$

$x^2 = 10.88$

$x = \sqrt{10.88}$

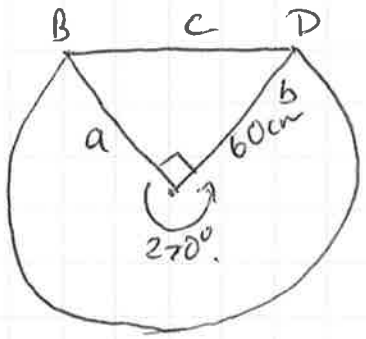
$x = 3.2984$

$x = 3.3\text{m}.$ to 1 dp.

b) $2.1 - 1.3 = 0.8\text{m}$

The same surface width would occur at a depth of 0.8m.

(12) 1999 Paper 2 Q6



$$\text{Arc length} = \frac{\text{Sector Angle}}{360^\circ} \times \pi D \qquad D = 2 \times 60$$

$$D = 120\text{cm}$$

$$\text{Arc length} = \frac{270^{90}}{360_{3}} \times \pi \times 120^{1}$$

$$\text{Arc length} = 282.743 \text{ cm}$$

For line BD

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

$$c^2 = 60^2 + 60^2$$

$$c^2 = 7200$$

$$c = \sqrt{7200}$$

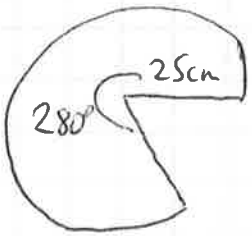
$$c = 84.853 \text{ cm}$$

$$\text{Perimeter} = 84.853 + 282.743$$

$$\text{Perimeter} = 367.596$$

$$\text{Perimeter} = 367.6 \text{ cm to 1 d.p.}$$

(13) 2000 Paper 2 Q11



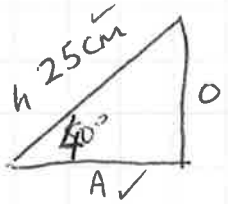
$$\text{Sector Area} = \frac{\text{Sector Angle}}{360} \times \pi r^2$$

$$\text{Sector Area} = \frac{280}{360} \times \pi \times 25^2$$

$$\text{Sector Area} = 1527.163$$

$$\text{Sector Area} = 1527.2 \text{ cm}^2$$

b)



SoH CaH ToA

$$\cos x^\circ = \frac{\text{adj}}{\text{hyp}}$$

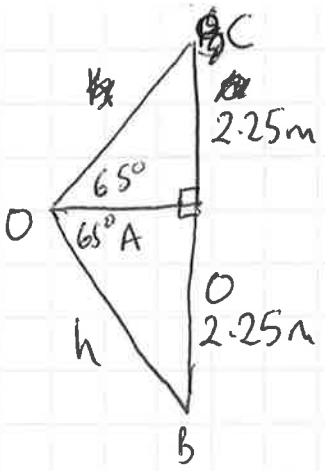
$$\cos 40^\circ = \frac{A}{25}$$

$$A = 25 \cos 40^\circ$$

$$A = 19.151 = 19.2\text{cm. to 1 dp.}$$

$$l = 19.2 + 25 = 44.2\text{cm} = 44 \text{ cm to nearest cm}$$

44 cm is the minimum length required.

(14) 

SOH CAH TOA 1998 Paper 2 Q3

$\sin x^\circ = \frac{opp}{hyp}$

$\sin 65^\circ = \frac{2.25}{h}$

$h = \frac{2.25}{\sin 65^\circ}$

$h = 2.4826 = 2.5m$

The length of OB is 2·5m.

b) Arc length $= \frac{\text{Sector Angle}}{360} \times \pi D$

Arc length $= \frac{130}{360} \times \pi \times (2.5 \times 2)$

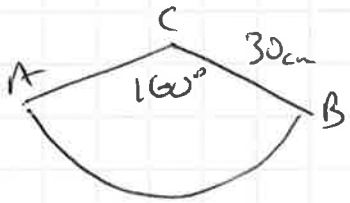
Arc length $= 5.632$ m.

Perimeter $= 5.632 + 8.3 + 4.5 + 8.3$

Perimeter $= 26.732$

Perimeter $= 26.7$m to 1 dp

(15) 1998 Paper 2 Q4



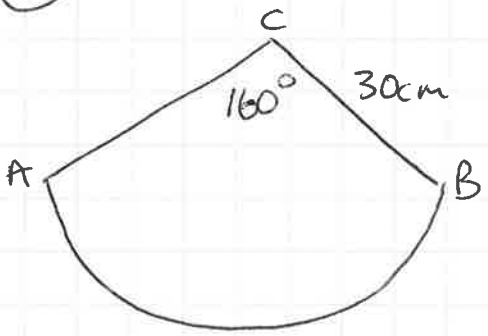
Arc length $= \frac{\text{Sector Angle}}{360^\circ} \times \pi D$

Arc length $= \frac{160}{360} \times \pi \times 60$

Arc length $= 83.7758$

Arc length $= 83.8$ cm

(16) 1997 Q1



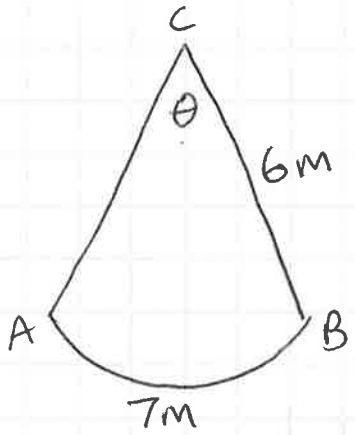
$$\text{Arc length} = \frac{\text{Sector Angle}}{360^\circ} \times \pi D$$

$$\text{Arc length} = \frac{160}{360} \times \pi \times 60$$

$$\text{Arc length} = 83.7758$$

$$\underline{\text{Arc length} = 83.8\text{ cm}}$$

(17) 1996 Q3



$$\frac{\text{Arc length}}{\pi D} = \frac{\text{Sector Angle}}{360}$$

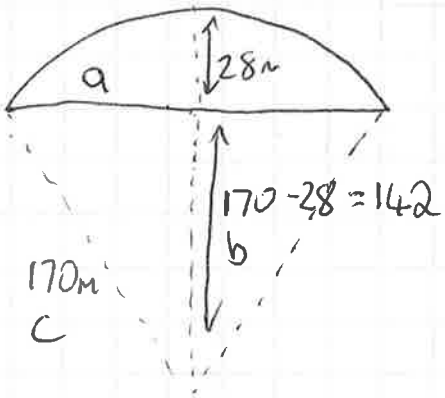
$$\frac{7\text{m}}{\pi \times 12} = \frac{\theta}{360}$$

$$0.185 = \frac{\theta}{360}$$

$$\theta = 66.845$$

$$\underline{\theta = 67^\circ \text{ to nearest degree}}$$

(18) 1995 Q14



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

$$170^2 = a^2 + 142^2$$

$$a^2 = 28900 - 20164$$

$$a^2 = 8736$$

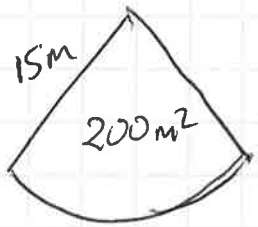
$$a = \sqrt{8736}$$

$$a = 93.4665$$

$$AB = 2 \times a = 2 \times 93.4665 = 186.933$$

$$\underline{= 186.9\text{ m}}$$

(19) 1994 Q10



$$\frac{\text{Arc length}}{\pi D} = \frac{\text{Sector Angle}}{360} = \frac{\text{Sector Area}}{\pi r^2}$$

$$\frac{\text{Arc length}}{\pi \times 30} = \frac{200}{\pi \times 15^2}$$

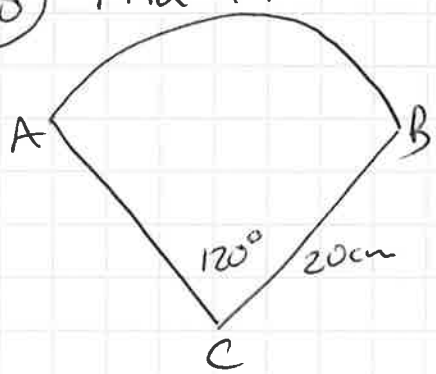
$$\frac{\text{Arc length}}{94.2478} = 0.2829$$

$$\text{Arc length} = 0.2829 \times 94.2478$$

$$\text{Arc length} = 26.6$$

$$\text{Arc length} = 26.7\text{m}$$

(20) 1992 Q1



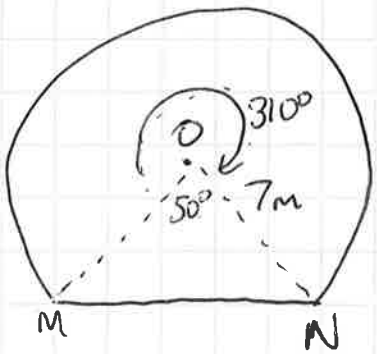
$$\text{Arc length} = \frac{\text{Sector Angle}}{360} \times \pi D$$

$$\text{Arc length} = \frac{120}{360} \times \pi \times 40$$

$$\text{Arc length} = 41.8879$$

$$\text{Arc length} = 41.9\text{ cm}$$

(21) 2014 Paper 2 Nat 5.



$$\text{Sector Area} = \frac{\text{Sector Angle}}{360} \times \pi r^2$$

$$\text{Sector Area} = \frac{310}{360} \times \pi \times 7^2$$

$$\text{Sector Area} = 132.5577$$

$$\text{Sector Area} = 132.6\text{ m}^2$$

$$\text{Area of } \Delta = \frac{1}{2}ab\sin C$$

$$\text{Area of } \Delta = \frac{1}{2} \times 7 \times 7 \times \sin 50$$

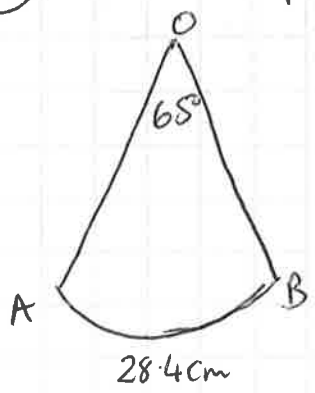
$$\text{Area of } \Delta = 18.768\text{ m}^2$$

$$\text{Total Area} = 132.5577 + 18.768$$

$$\text{Total Area} = 151.325$$

$$\text{Total Area} = 151.3\text{ m}^2$$

(22) 2015 Paper 2 Nat 5 Q13



$$\text{Arc length} = \frac{\text{Sector Angle}}{360} \times \pi D$$

$$28.4 = \frac{65}{360} \times \pi \times D$$

$$28.4 = 0.5672 \times D$$

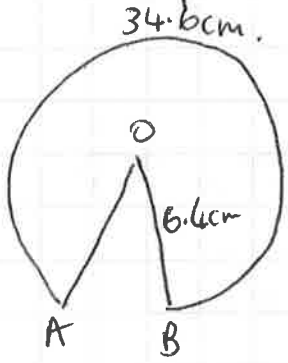
$$D = 28.4 \div 0.5672$$

$$D = 50.067$$

~~D = 50~~

Length of Pendulum $= D \div 2 = 50.067 \div 2 = 25\text{cm}$.

(23) 2015 Paper 2 Int 2. Q10



$$\frac{\text{Arc length}}{\pi D} = \frac{\text{Sector Angle}}{360} = \frac{\text{Sector Area}}{\pi r^2}$$

$$\frac{34.6}{\pi \times 12.8} = \frac{\theta}{360}$$

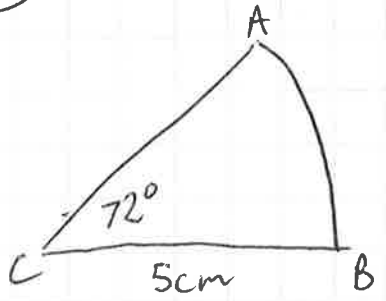
$$0.8604 = \frac{\theta}{360}$$

$$\theta = 0.8604 \times 360$$

$$\theta = 309.755$$

$$\theta = 310^\circ$$

(24) 2013 Paper 1 Int 2. Q3

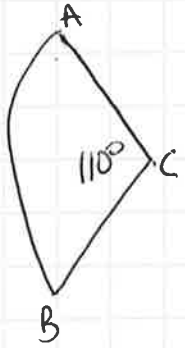


$$\text{Arc length} = \frac{\text{Sector Angle}}{360} \times \pi D$$

$$\text{Arc length} = \frac{\cancel{72}^{1}}{\cancel{360}_{5}} \times 3.14 \times \cancel{10}^{2}$$

$$\text{Arc length} = 6.28\text{cm}$$

(25) 2012 Paper 2 Int 2 Q1



$C = 40.8\text{cm}$

$$\frac{\text{Arc length}}{\pi D} = \frac{\text{Sector Angle}}{360} = \frac{\text{Sector Area}}{\pi r^2}$$

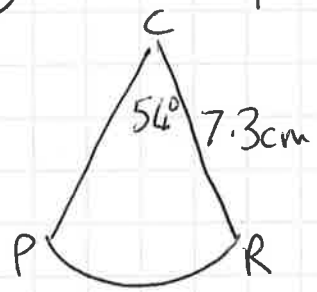
$$\frac{\text{Arc length}}{40.8} = \frac{110}{360}$$

$$\text{Arc length} = \frac{110}{360} \times 40.8$$

$$\text{Arc length} = 12.466$$

$$\text{Arc length} = 12.5\text{cm}$$

(26) 2011 Paper 2 Int 2. Q5.



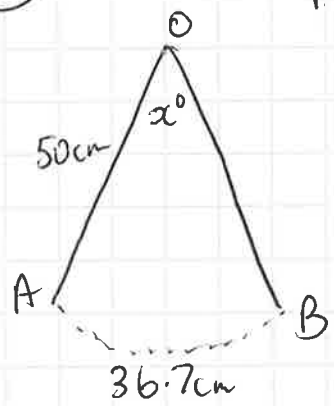
$$\text{Sector Area} = \frac{\text{Sector Angle}}{360} \times \pi r^2$$

$$\text{Sector Area} = \frac{54}{360} \times \pi \times 7.3^2$$

$$\text{Sector Area} = 25.1123$$

$$\text{Sector Area} = 25.1\text{cm}^2$$

(27) 2013 Paper 2 Credit Q8



$$\frac{\text{Arc length}}{\pi D} = \frac{\text{Sector Angle}}{360} = \frac{\text{Sector Area}}{\pi r^2}$$

$$\frac{36.7}{\pi \times 100} = \frac{x}{360}$$

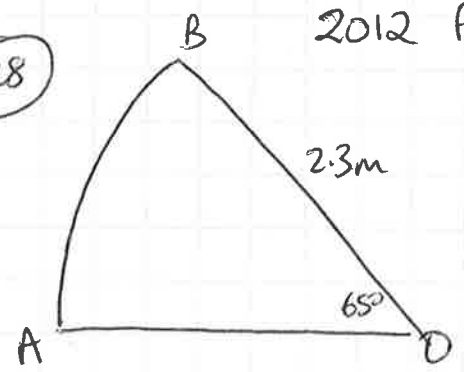
$$0.1168 = \frac{x}{360}$$

$$x = 0.1168 \times 360$$

$$x = 42.055$$

$$x = 42°$$

(28) 2012 Paper 2 Credit Q4



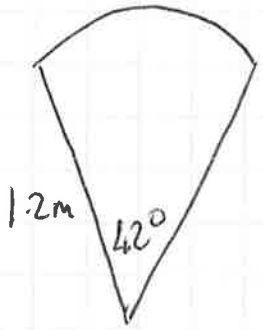
$$\text{Arc length} = \frac{\text{Sector Angle}}{360} \times \pi D$$

$$\text{Arc length} = \frac{65}{360} \times \pi \times 4.6$$

$$\text{Arc length} = 2.6092$$

$$\text{Arc length} = 2.6\text{m}$$

(29) 2011 Paper 2 Credit Q5



$$\text{Arc length} = \frac{\text{Sector Angle}}{360} \times \pi D$$

$$\text{Arc length} = \frac{42}{360} \times \pi \times 2.4$$

$$\text{Arc length} = 0.8796$$

$$\text{Arc length} = 0.88\text{ m}$$

No this would not pass safety regulations as the arc length is 0.88m which is less than 0.9m.