MATHEMATICS

Stage 4

Measurement and Space, Length

Circles

Teacher: Chi Binh Le

Exam Equivalent Time: 144 minutes *(based on allocation ~1.25 min/mark)*

norWEST CHRISTIAN COLLEGE
STRENGTH OF PURPOSE

Questions

1. D Circles (254044) Core

Which of the following is the definition of the diameter of a circle?

A. The distance across a circle passing through the centre.

B. A portion of the circumference of a circle.

C. The distance around the circle.

D. The distance from the centre of the circle to its circumference.

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2. D Circles (254053) Core

Which of the following is the definition of the circumference of a circle?

A. The distance across a circle passing through the centre.

B. A portion of the circumference of a circle.

C. The distance along the boundary of the circle.

D. The distance from the centre of the circle to its circumference.

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3. D Circles (254048) Core

Which of the following is the definition of the radius of a circle?

A. The distance across a circle passing through the centre.

B. A portion of the circumference of a circle.

C. The distance around the circle.

D. The distance from the centre of the circle to its circumference.

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4. D Circles (254031) Core

Which of the following is the definition of an arc?

A. The distance across a circle passing through the centre.

B. A portion of the circumference of a circle.

C. The distance around the circle.

D. A line that touches a circle at only one point.

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5. B+ Circles (254150) Core

A car tyre has a circumference of 120 cm.

Which of these is closest to the radius of the tyre?

A. 9.5 cm

B. 19.1 cm

C. 38.0 cm

D. 753.6 cm

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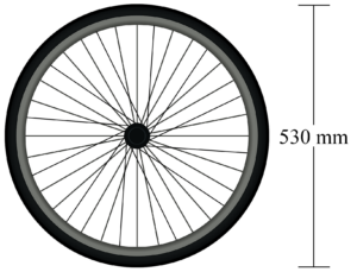
6. B+ Circles (254132) Core

A wheel on a bicycle has a diameter of 530 mm.



The wheel turns 12 times.

Approximately how many metres has the bicycle travelled?

A. 6 m

B. 20 m

C. 40 m

D. 399 m

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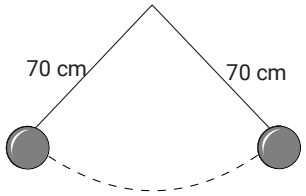
7. A Circles (254146) Core

A yoyo at the end of a string moves through a quarter circle arc, as shown below.

The string is 70 cm long.



The curved distance the yoyo has travelled is closest to

A. 80 cm

B. 90 cm

C. 100 cm

D. 110 cm

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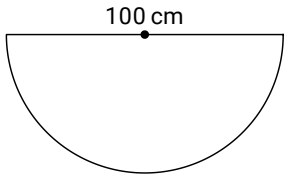
8. E Circles (254305) Core

Calculate the total perimeter of the sector below, giving your answer as an exact value in terms of π. *(2 marks)*



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9. D Circles (253997) Core

If the diameter of a circle is 16.2 millimetres, what is the length of its radius? *(1 mark)*

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10. D Circles (254058) Core

Evaluate 5π using a calculator, giving your answer correct to 2 decimal places. *(1 mark)*

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11. D Circles (253990) Core

If the radius of a circle is 24 centimetres, what is the length of its diameter? *(1 mark)*

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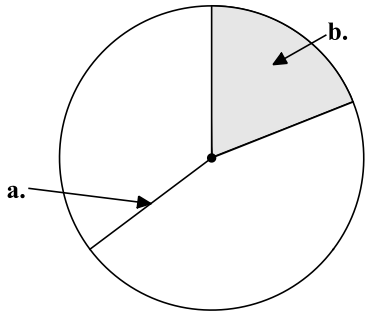
12. D Circles (253967) Core

Name the circle parts indicated in the drawing below. *(2 marks)*



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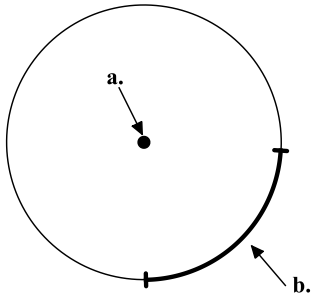
13. D Circles (253975) Core

Name the circle parts indicated in the drawing below. *(2 marks)*



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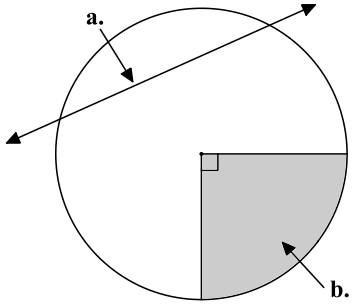
14. D Circles (253984) Core

Name the circle parts indicated in the drawing below. *(2 marks)*



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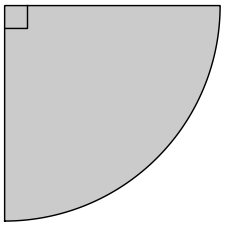
15. D Circles (254064) Core

Use a calculator to evaluate $2\pi r$ correct to 1 decimal place, when $r = 2.1$. *(2 marks)*

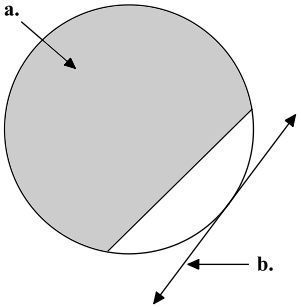
16. D Circles (254024) Core

What fraction of a circle is indicated in the diagram below? *(1 mark)*



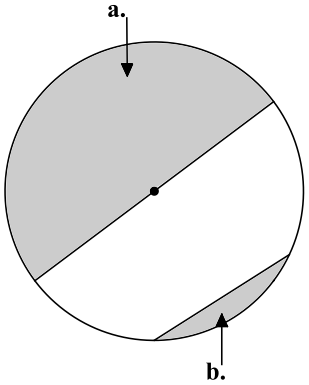
17. D Circles (253979) Core

Name the circle parts indicated in the drawing below. *(2 marks)*



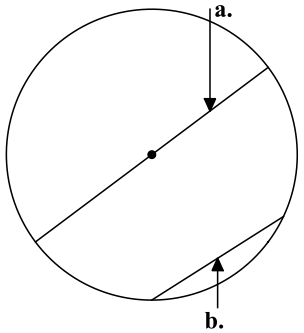
18. D Circles (253972) Core

Name the circle parts indicated in the drawing below. *(2 marks)*



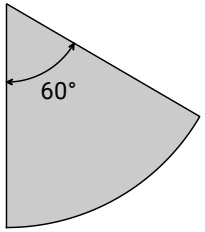
19. D Circles (253646) Core

Name the circle parts indicated in the drawing below. *(2 marks)*



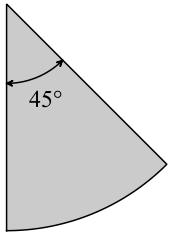
20. D Circles (254000) Core

What fraction of a circle is indicated in the diagram below? *(1 mark)*



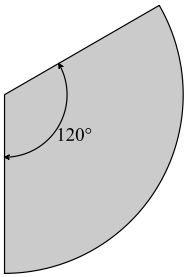
21. D Circles (254017) Core

What fraction of a circle is indicated in the diagram below? *(1 mark)*



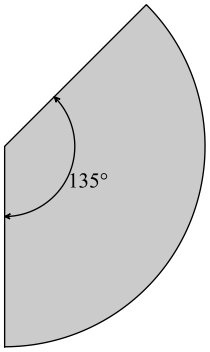
22. D Circles (254007) Core

What fraction of a circle is indicated in the diagram below? *(1 mark)*



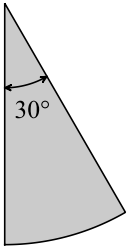
23. D Circles (254020) Core

What fraction of a circle is indicated in the diagram below? *(1 mark)*



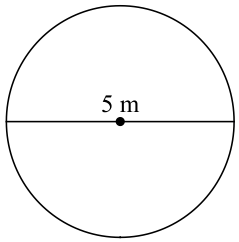
24. D Circles (254026) Core

What fraction of a circle is indicated in the diagram below? *(1 mark)*



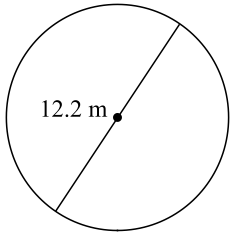
25. C Circles (254090) Core

Calculate the circumference of the circle below correct to two decimal places. *(2 marks)*



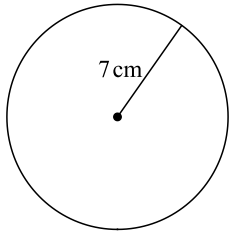
26. C Circles (254100) Core

Calculate the circumference of the circle below correct to one decimal place. *(2 marks)*



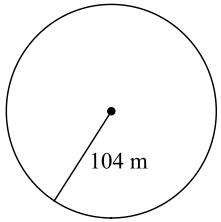
27. C Circles (254102) Core

Calculate the circumference of the circle below correct to one decimal place. *(2 marks)*



28. C Circles (254105) Core

Calculate the circumference of the circle below correct to two decimal places. *(2 marks)*



29. C Circles (254107) Core

Calculate the circumference of a circle with a diameter of 35 centimetres, correct to two decimal places. *(2 marks)*

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30. C Circles (254109) Core

Calculate the circumference of a circle with a diameter of 24.6 millimetres, correct to 0ne decimal place. *(2 marks)*

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31. B Circles (254111) Core

Calculate the circumference of a circle with a radius of 453 kilometres, correct to the nearest whole number. *(2 marks)*

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32. B Circles (254115) Core

Calculate the circumference of a circle with a radius of 1012 centimetres, correct to the nearest hundred. *(2 marks)*

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33. B Circles (254117) Core

Calculate the diameter of a circle with a circumference of 24 centimetres, correct to 1 decimal place. *(2 marks)*

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34. B Circles (254120) Core

Calculate the diameter of a circle with a circumference of 109.8 metres, correct to 2 decimal places. *(2 marks)*

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35. B Circles (254396) Core

Given the earths' radius is approximately 6400 kilometres, calculate the distance, d, around the earth at the equator. Give your answer correct to the nearest whole kilometre. *(2 marks)*

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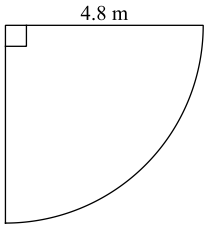
36. B+ Circles (254221) Core

Use the arc length formula below to calculate the arc length of the sector, correct to two decimal places. *(2 marks)*

$$l = \frac{\theta}{360} \times 2\pi r$$



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37. B+ Circles (254125) Core

Calculate the radius of a circle with a circumference of 324 centimetres, correct to 2 decimal places. *(2 marks)*

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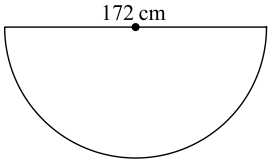
38. B+ Circles (254234) Core

Calculate the arc length of the sector below, correct to two decimal places. *(2 marks)*

$$l = \frac{\theta}{360} \times 2\pi r$$



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39. B+ Circles (254127) Core

Calculate the radius of a circle with a circumference of 870 metres, correct to the nearest ten metres. *(2 marks)*

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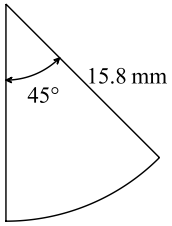
40. B+ Circles (254213) Core

Use the arc length formula below to calculate the arc length of the sector, correct to one decimal place. *(2 marks)*

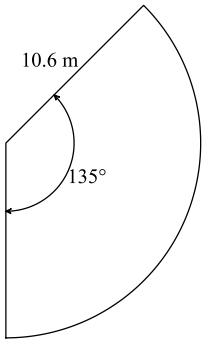
$$l = \frac{\theta}{360} \times 2\pi r$$



41. B+ Circles (254187) Core

Use the arc length formula below to calculate the arc length of the sector, correct to one decimal place. *(2 marks)*

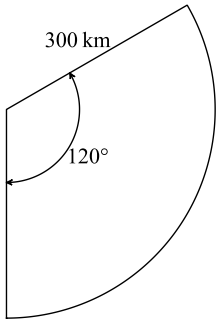
$$l = \frac{\theta}{360} \times 2\pi r$$



42. B+ Circles (254205) Core

Use the arc length formula below to calculate the arc length of the sector, correct to the nearest whole number. *(2 marks)*

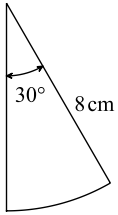
$$l = \frac{\theta}{360} \times 2\pi r$$



43. B+ Circles (254166) Core

Use the arc length formula below to calculate the arc length of the sector, correct to one decimal place. *(2 marks)*

$$l = \frac{\theta}{360} \times 2\pi r$$

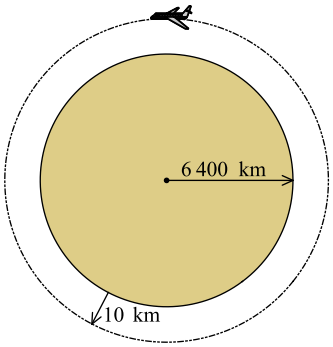


44. B+ Circles (254412) Core

A plane is circumnavigating the earth at the equator. It is cruising at a constant altitude of 10 kilometres above the earths' surface.

Given the earths' radius is approximately 6400 kilometres at the equator, calculate the distance, d, that the plane has travelled after completing one lap of the earth.

Give your answer correct to the nearest whole kilometre. ***(3 marks)***

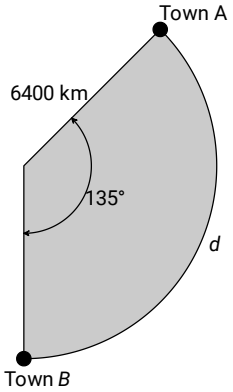


Not to scale

45. B+ Circles (254390) Core

Town A is 135° east of Town B along the equator, as shown on the diagram below.

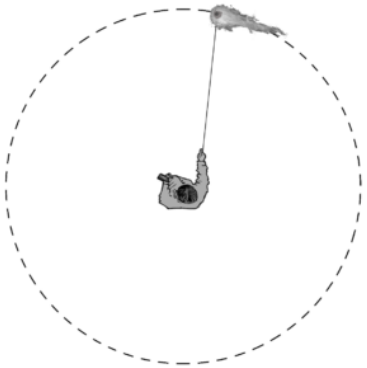
Given the earths' radius is approximately 6400 kilometres, calculate the distance d, between the two towns. Give your answer correct to the nearest whole kilometre. ***(2 marks)***



NOTE: $\textbf{Arc length} = \frac{\theta}{360} \times 2\pi r$

46. A Circles (254140) Core

Guerra slings a fire torch in a circle at the end of a 3 metre rope.

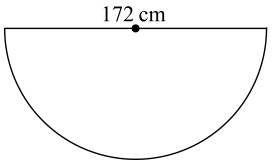


How far has the fire torch travelled after completing 15 circles?

Give your answer correct to the nearest whole number. ***(2 marks)***

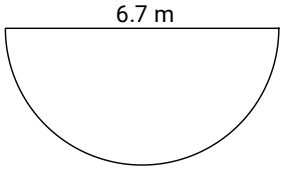
47. A Circles (254253) Core

Calculate the total perimeter of the sector below, correct to one decimal place. ***(2 marks)***



48. A Circles (254293) Core

Calculate the total perimeter of the sector below, correct to one decimal place. ***(2 marks)***



49. A Circles (254155) Core

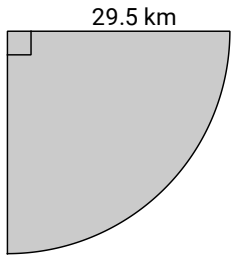
Evan rides his bike around a circular track with a radius of 150 metres.

He rides the track 5 days a week and wants to have ridden 230 kilometres by the end of the week.

What is the minimum number of laps, to the nearest whole lap, he must complete each day to achieve his target? ***(3 marks)***

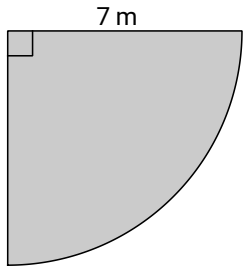
50. A Circles (254334) Core

Calculate the total perimeter of the quadrant below, giving your answer correct to one decimal place. ***(2 marks)***



51. A Circles (254311) Core

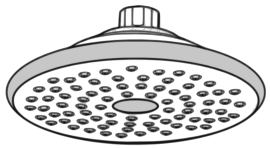
Calculate the total perimeter of the quandrant below, giving your answer as an exact value in terms of π. ***(2 marks)***



52. A Circles (254068) Core

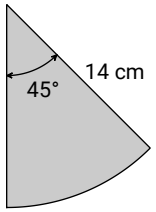
Percy has a large shower head which has a diameter of 25.5 centimetres.

What is the circumference of the shower head in centimetres, correct to one decimal place? ***(2 marks)***



53. A+ Circles (254364) Core

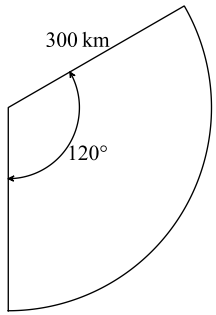
Calculate the total perimeter of the sector below, giving your answer correct to one decimal place. ***(2 marks)***



NOTE: $\textbf{Perimeter} = 2 \times \textbf{radius} + \textbf{arc length}$

54. A+ Circles (254371) Core

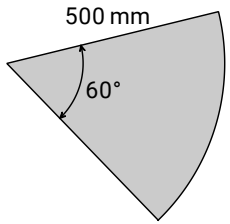
Calculate the total perimeter of the sector below, giving your answer correct to the nearest whole number. ***(2 marks)***



NOTE: $\textbf{Perimeter} = 2 \times \textbf{radius} + \textbf{arc length}$

55. A+ Circles (254345) Core

Calculate the total perimeter of the sector below, giving your answer correct to one decimal place. ***(2 marks)***

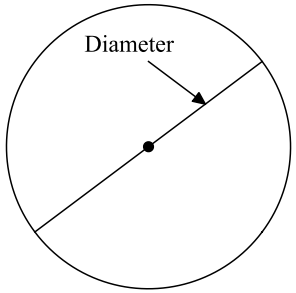


NOTE: $\textbf{Perimeter} = 2 \times \textbf{radius} + \textbf{arc length}$

Worked Solutions

1. D Circles (254044) Core

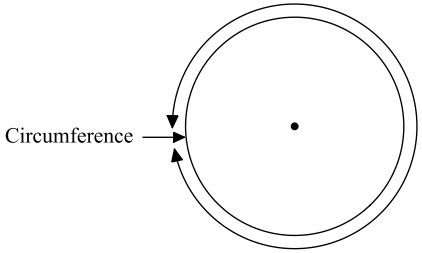
The diameter is the distance across a circle passing through the centre.



$\Rightarrow A$

2. D Circles (254053) Core

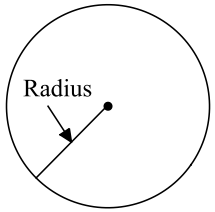
The circumference is the distance along the boundary a circle.



$\Rightarrow C$

3. D Circles (254048) Core

The radius is the distance from the centre of a circle to the circumference.

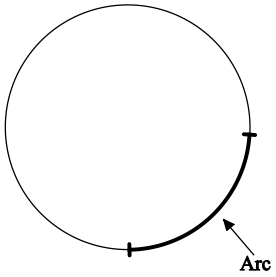


$\Rightarrow D$

Worked Solutions

4. D Circles (254031) Core

An arc is a section of the circumference of a circle.



$\Rightarrow B$

5. B+ Circles (254150) Core

$$
\begin{aligned}
C &= 2\pi r \\
120 &= 2 \times \pi \times r \\
r &= \frac{120}{2\pi} \\
&= 19.098\ldots \\
&\approx 19.1 \text{ cm}
\end{aligned}
$$

$\Rightarrow B$

6. B+ Circles (254132) Core

$$
\begin{aligned}
&\text{Diameter} = 530 \text{ mm} = 0.530 \text{ m} \\
&\therefore \text{Distance} = 12 \times \text{circumference} \\
&\qquad = 12 \times \pi d \\
&\qquad = 12 \times \pi \times 0.530 \\
&\qquad = 19.9805\ldots \\
&\qquad = 20 \text{ m (nearest m)}
\end{aligned}
$$

$\Rightarrow B$

7. A Circles (254146) Core

$$
\begin{aligned}
\text{Distance} &= \frac{1}{4} \times 2\pi r \\
&= \frac{1}{4} \times 2\pi 70 \\
&= 109.9557\ldots \\
&\approx 110 \text{ cm}
\end{aligned}
$$

$\Rightarrow D$

8. E Circles (254305) Core

$$\text{Perimeter} = \text{diameter} + \frac{\text{circumference}}{2}$$

$$\begin{aligned}\text{Perimeter} &= d + \frac{\pi d}{2} \\ &= 100 + \left(\frac{\pi \times 100}{2}\right) \\ &= 100 + 50\pi \text{ cm}\end{aligned}$$

---

9. D Circles (253997) Core

$$\begin{aligned}\text{Radius} &= \frac{\text{diameter}}{2} \\ &= \frac{16.2}{2} \\ &= 8.1\text{mm}\end{aligned}$$

---

10. D Circles (254058) Core

$$\begin{aligned}5\pi &= 15.7079\ldots \\ &= 15.71 \text{ (2 d.p.)}\end{aligned}$$

---

11. D Circles (253990) Core

$$\begin{aligned}\text{Diameter} &= 2 \times \text{radius} \\ &= 2 \times 24 \\ &= 48 \text{ cm}\end{aligned}$$

---

12. D Circles (253967) Core

a. Radius

b. Sector

---

13. D Circles (253975) Core

a. Centre

b. Arc

---

14. D Circles (253984) Core

a. Secant

b. Quadrant

---

15. D Circles (254064) Core

$$\begin{aligned}2\pi r &= 2 \times \pi \times 2.1 \\ &= 13.194\ldots \\ &= 13.2 \text{ (1 d.p.)}\end{aligned}$$

---

16. D Circles (254024) Core

$$\begin{aligned}\text{Angle} &= \frac{\theta}{360} \\ &= \frac{90}{360} \\ &= \frac{1}{4}\end{aligned}$$

---

17. D Circles (253979) Core

a. Major segment

b. Tangent

---

18. D Circles (253972) Core

a. Semicircle

b. Minor segment

---

19. D Circles (253646) Core

a. Diameter

b. Chord

---

20. D Circles (254000) Core

$$\begin{aligned}\text{Angle} &= \frac{\theta}{360} \\ &= \frac{60}{360} \\ &= \frac{1}{6}\end{aligned}$$

---

21. D Circles (254017) Core

$$\begin{aligned}\text{Angle} &= \frac{\theta}{360} \\ &= \frac{45}{360} \\ &= \frac{1}{8}\end{aligned}$$

---

22. D Circles (254007) Core

$$\begin{aligned}\text{Angle} &= \frac{\theta}{360} \\ &= \frac{120}{360} \\ &= \frac{1}{3}\end{aligned}$$

---

23. D Circles (254020) Core

$$\begin{aligned}\text{Angle} &= \frac{\theta}{360} \\ &= \frac{135}{360} \\ &= \frac{3}{8}\end{aligned}$$

---

24. D Circles (254026) Core

$$\begin{aligned}\text{Angle} &= \frac{\theta}{360} \\ &= \frac{30}{360} \\ &= \frac{1}{12}\end{aligned}$$

---

25. C Circles (254090) Core

$$\begin{aligned}C &= \pi d \\ &= \pi \times 5 \\ &= 15.7079\ldots \\ &= 15.71 \text{ m } (2 \text{ d.p.})\end{aligned}$$

---

26. C Circles (254100) Core

$$\begin{aligned}C &= \pi d \\ &= \pi \times 12.2 \\ &= 38.3274\ldots \\ &= 38.3 \text{ m } (1 \text{ d.p.})\end{aligned}$$

---

27. C Circles (254102) Core

$$\begin{aligned}C &= 2\pi r \\ &= 2\pi \times 7 \\ &= 43.9822\ldots \\ &= 44.0 \text{ cm } (1 \text{ d.p.})\end{aligned}$$

---

28. C Circles (254105) Core

$$\begin{aligned}C &= 2\pi r \\ &= 2\pi \times 104 \\ &= 653.4512\ldots \\ &= 653.45 \text{ cm } (2 \text{ d.p.})\end{aligned}$$

---

29. C Circles (254107) Core

$$\begin{aligned}C &= \pi d \\ &= \pi \times 35 \\ &= 109.9557\ldots \\ &= 109.96 \text{ cm } (2 \text{ d.p.})\end{aligned}$$

---

30. C Circles (254109) Core

$$\begin{aligned}C &= \pi d \\ &= \pi \times 24.6 \\ &= 77.2831\ldots \\ &= 77.3 \text{ mm } (1 \text{ d.p.})\end{aligned}$$

---

31. B Circles (254111) Core

$$\begin{aligned} C &= 2\pi r \\ &= 2\pi \times 453 \\ &= 2846.2829\ldots \\ &= 2846 \text{ km (nearest whole number)} \end{aligned}$$

32. B Circles (254115) Core

$$\begin{aligned} C &= 2\pi r \\ &= 2\pi \times 1012 \\ &= 6358.5835\ldots \\ &= 6400 \text{ cm (nearest hundred)} \end{aligned}$$

33. B Circles (254117) Core

$$\begin{aligned} C &= \pi d \\ 24 &= \pi d \\ d &= \frac{24}{\pi} \\ &= 7.639\ldots \\ &= 7.6 \text{ cm (1 d.p.)} \end{aligned}$$

34. B Circles (254120) Core

$$\begin{aligned} C &= \pi d \\ 109.8 &= \pi d \\ d &= \frac{109.8}{\pi} \\ &= 34.9504\ldots \\ &= 34.95 \text{ m (2 d.p.)} \end{aligned}$$

35. B Circles (254396) Core

$$\begin{aligned} d &= 2\pi r \\ &= 2\pi \times 6400 \\ &= 40\,212.3859\ldots \\ &= 40\,212 \text{ km (nearest whole kilometre)} \end{aligned}$$

$\therefore$ The distance around the earth at the equator is approximately 40 212 kilometres.

36. B+ Circles (254221) Core

$$\begin{aligned} l &= \frac{\theta}{360} \times 2\pi r \\ &= \frac{90}{360} \times 2\pi \times 4.8 \\ &= 7.5398\ldots \\ &= 7.54 \text{ m (2 d.p.)} \end{aligned}$$

37. B+ Circles (254125) Core

$$\begin{aligned} C &= 2\pi r \\ 324 &= 2\pi r \\ r &= \frac{324}{2\pi} \\ &= 51.5662\ldots \\ &= 51.57 \text{ cm (2 d.p.)} \end{aligned}$$

38. B+ Circles (254234) Core

Diameter $= 172$cm

$\therefore$ Radius $= \frac{172}{2} = 86$cm

Method 1

$$\begin{aligned} l &= \frac{\theta}{360} \times 2\pi r \\ &= \frac{180}{360} \times 2\pi \times 86 \\ &= 270.1769\ldots \\ &= 270.18 \text{ m (2 d.p.)} \end{aligned}$$

Method 2

$$\begin{aligned} l &= \frac{1}{2} \times \text{circumference} \\ &= \frac{1}{2} \times \pi d \\ &= \frac{1}{2} \times \pi \times 172 \\ &= 270.1769\ldots \\ &= 270.18 \text{ m (2 d.p.)} \end{aligned}$$

39. B+ Circles (254127) Core

$$
\begin{aligned}
C &= 2\pi r \\
870 &= 2\pi r \\
r &= \frac{870}{2\pi} \\
&= 138.4648\ldots \\
&= 140 \text{ m (nearest ten)}
\end{aligned}
$$

---

40. B+ Circles (254213) Core

$$
\begin{aligned}
l &= \frac{\theta}{360} \times 2\pi r \\
&= \frac{45}{360} \times 2\pi \times 15.8 \\
&= 12.4092\ldots \\
&= 12.4 \text{ mm (1 d.p.)}
\end{aligned}
$$

---

41. B+ Circles (254187) Core

$$
\begin{aligned}
l &= \frac{\theta}{360} \times 2\pi r \\
&= \frac{135}{360} \times 2\pi \times 10.6 \\
&= 24.9756\ldots \\
&= 25.0 \text{ m (1.d.p.)}
\end{aligned}
$$

---

42. B+ Circles (254205) Core

$$
\begin{aligned}
l &= \frac{\theta}{360} \times 2\pi r \\
&= \frac{120}{360} \times 2\pi \times 300 \\
&= 628.3185\ldots \\
&= 628 \text{ km (nearest whole number)}
\end{aligned}
$$

---

43. B+ Circles (254166) Core

$$
\begin{aligned}
l &= \frac{\theta}{360} \times 2\pi r \\
&= \frac{30}{360} \times 2\pi \times 8 \\
&= 4.1887\ldots \\
&= 4.2 \text{ cm (1.d.p.)}
\end{aligned}
$$

---

44. B+ Circles (254412) Core

Radius of planes' path $= 6400 + 10 = 6410$ km

$$
\begin{aligned}
d &= 2\pi r \\
&= 2\pi \times 6410 \\
&= 40\,275.2178\ldots \\
&= 40\,275 \text{ km (nearest whole kilometre)}
\end{aligned}
$$

$\therefore$ The distance the plane travels around the earth at the equator is approximately 40 275 kilometres.

---

45. B+ Circles (254390) Core

$$
\begin{aligned}
d &= \frac{\theta}{360} \times 2\pi r \\
&= \frac{135}{360} \times 2\pi \times 6400 \\
&= 15\,079.6447\ldots \\
&= 15\,080 \text{ km (nearest whole kilometre)}
\end{aligned}
$$

$\therefore$ Towns A and B are 15 080 kilometres apart.

---

46. A Circles (254140) Core

Distance travelled in 1 revolution:

$$
\begin{aligned}
C &= 2\pi r \\
&= 2 \times \pi \times 3 \\
&= 18.8495\ldots
\end{aligned}
$$

$\therefore$ Distance travelled in 15 revolutions:

$$
\begin{aligned}
&= 15 \times 18.8495\ldots \\
&= 282.7433\ldots \\
&= 283 \text{ metres (nearest whole number)}
\end{aligned}
$$

---

47. A Circles (254253) Core

$$\text{Perimeter} = \text{diameter} + \frac{\text{circumference}}{2}$$

$$\begin{aligned}\text{Perimeter} &= d + \frac{\pi d}{2} \\ &= 172 + \left(\frac{\pi \times 172}{2}\right) \\ &= 442.1769\ldots \\ &= 442.2 \text{ cm } (1 \text{ d.p.})\end{aligned}$$

48. A Circles (254293) Core

$$\text{Perimeter} = \text{diameter} + \frac{\text{circumference}}{2}$$

$$\begin{aligned}\text{Perimeter} &= d + \frac{\pi d}{2} \\ &= 6.7 + \left(\frac{\pi \times 6.7}{2}\right) \\ &= 17.2243\ldots \\ &= 17.2 \text{ cm } (1 \text{ d.p.})\end{aligned}$$

49. A Circles (254155) Core

$$\text{Total Distance} = 230 \text{ km} = 230\,000 \text{ m}$$

$$\begin{aligned}\text{Total laps} &= \frac{230\,000}{C} \\ &= \frac{230\,000}{300\pi} \\ &= 244.037\ldots\end{aligned}$$

$$\begin{aligned}\text{Laps per day:} &= \frac{244.037\ldots}{5} \\ &= 48.807\ldots \\ &\approx 49 \text{ laps}\end{aligned}$$

$\therefore$ Evan needs to ride 49 laps per day to achieve his goal.

$\left[\text{Check: } 49 \times 5 \times 300\pi = 230\,907.06 \text{ m} = 230.907 \text{ km}\right]$

50. A Circles (254334) Core

$$\text{Perimeter} = 2 \times \text{radius} + \frac{\text{circumference}}{4}$$

$$\begin{aligned}\text{Perimeter} &= 2r + \frac{2\pi r}{4} \\ &= 2 \times 29.5 + \left(\frac{2\pi \times 29.5}{4}\right) \\ &= 105.3384\ldots \\ &= 105.3 \text{ km } (1 \text{ d.p.})\end{aligned}$$

51. A Circles (254311) Core

$$\text{Perimeter} = 2 \times \text{radius} + \frac{\text{circumference}}{4}$$

$$\begin{aligned}\text{Perimeter} &= 2r + \frac{2\pi r}{4} \\ &= 2 \times 7 + \left(\frac{2\pi \times 7}{4}\right) \\ &= 14 + \frac{7\pi}{2} \text{ m}\end{aligned}$$

52. A Circles (254068) Core

$$\begin{aligned}C &= \pi d \\ &= \pi \times 25.5 \\ &= 80.110\ldots \\ &= 80.1 \text{ cm } (1 \text{ d.p.})\end{aligned}$$

53. A+ Circles (254364) Core

$$\text{Perimeter} = 2 \times \text{radius} + \text{arc length}$$

$$\begin{aligned}\text{Perimeter} &= 2r + \frac{\theta}{360} \times 2\pi r \\ &= 2 \times 14 + \left(\frac{45}{360} \times 2\pi \times 14\right) \\ &= 24.9955\ldots \\ &= 25.0 \text{ cm } (1 \text{ d.p.})\end{aligned}$$

54. A+ Circles (254371) Core

$$\text{Perimeter} = 2 \times \text{radius} + \text{arc length}$$

$$\begin{aligned}\text{Perimeter} &= 2r + \frac{\theta}{360} \times 2\pi r \\ &= 2 \times 300 + \left(\frac{120}{360} \times 2\pi \times 300\right) \\ &= 928.3185\ldots \\ &= 928 \text{ km } (\text{nearest whole number})\end{aligned}$$

55. A+ Circles (254345) Core

$$\text{Perimeter} = 2 \times \text{radius} + \text{arc length}$$

$$\begin{aligned}\text{Perimeter} &= 2r + \frac{\theta}{360} \times 2\pi r \\ &= 2 \times 500 + \left(\frac{60}{360} \times 2\pi \times 500\right) \\ &= 1523.5987\ldots \\ &= 1523.6 \text{ mm } (1 \text{ d.p.})\end{aligned}$$