# Area and Circumference of a Circle

Name parts of a circle

Calculate area of a circle

Calculate circumference of a circle

# Vocabulary

**Arc**
Part of the circumference of a circle.

**Diameter**
The distance from one point on a circle through the centre to another point on the circle.

**Sector**
Part of a circle bounded by two radii and an arc.

**Radius**
A line joining the centre of a circle to the circumference.

**Circumference**
The perimeter of a circle.

# Parts of a circle

Match each word with a part of the circle.

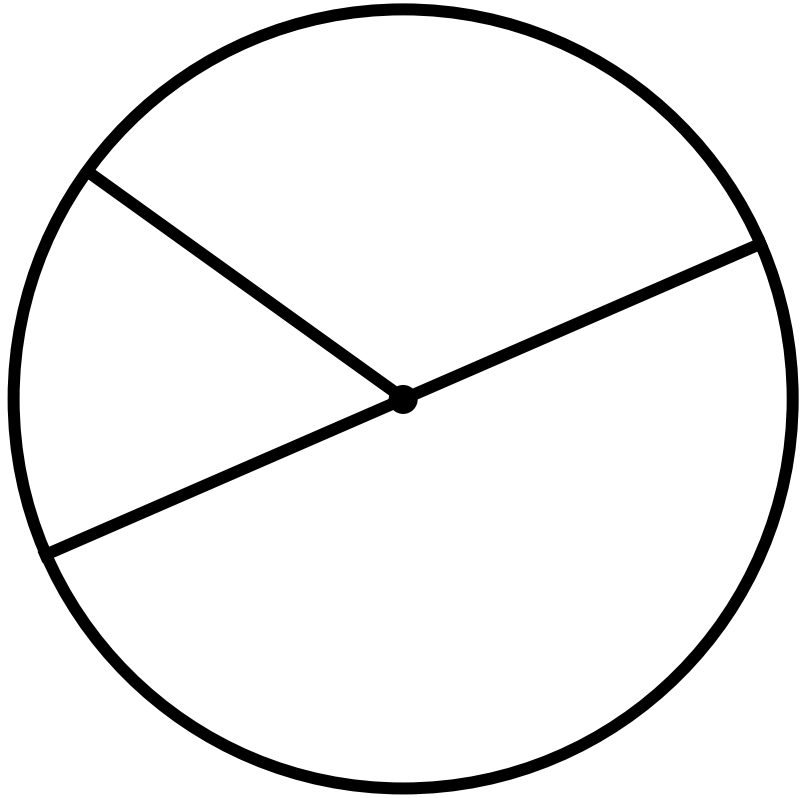
**Arc**

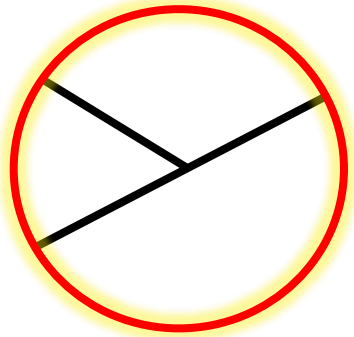
**Circumference**

**Diameter**

**Radius**

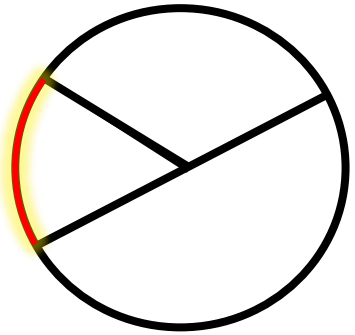
**Sector**





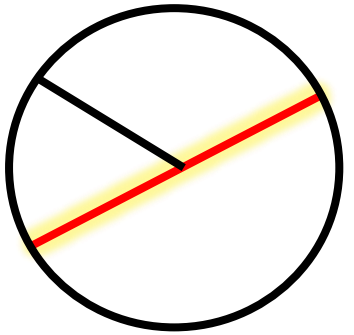
## Circumference

The distance around a circle.



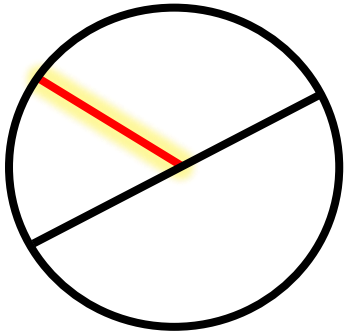
## Arc

A part of the circumference of a circle.



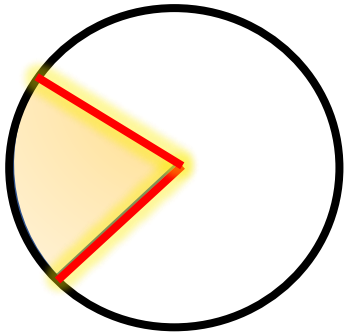
## Diameter

A line drawn from one part of the circumference to another, passing through the centre.



## Radius

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



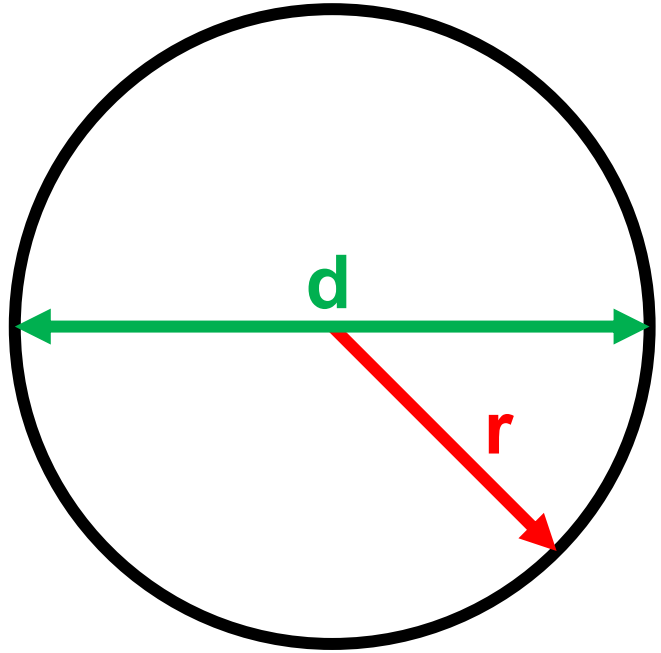
## Sector

An area bounded by two radii and the circumference.

# Key Facts

Area of any circle = $\pi \times r^2$

Circumference of any circle = $\pi \times d$

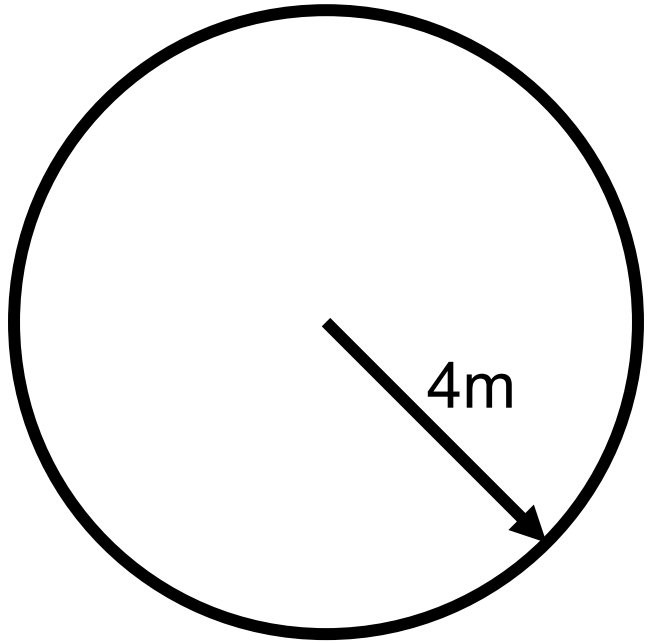


$$\pi \approx$$

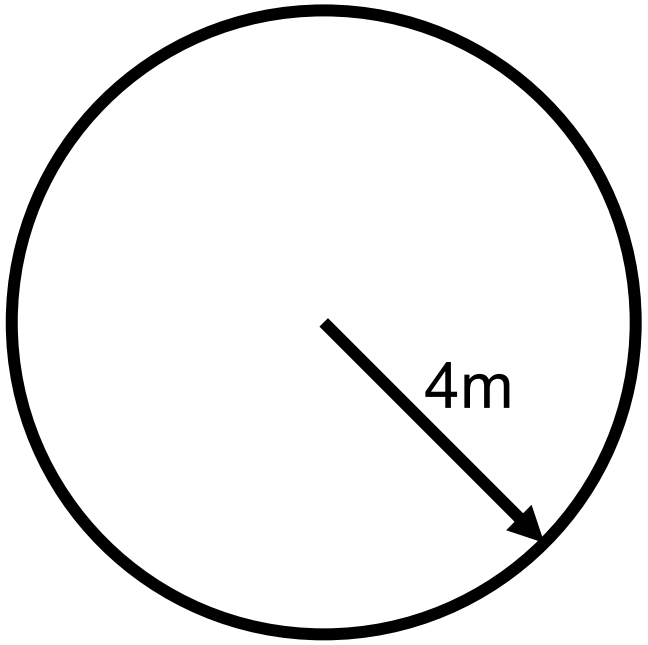
3.14159265358979323846264338327950288419716939937510582097494459230781640628620899862803482534211706798214808651328230664709384460955058223172535940812848111745028410270193852110555964462294895493038196442881097566593344612847564823378678316527120190914564856692346034861045432664821339360726024914127372458700660631558817488152092096282925409171536436789259036001133053054882046652138414695194151160943305727036575959195309218611738193261179310511854807446237996274956735188575272489122793818301194912983367336244065664308602139494639522473719070217986094370277053921717629317675238467481846766940513200056812714526356082778577134275778960917363717872146844090122495343014654958537105079227968925892354201995611212902196086403441815981362977477130996051870721134999999837297804995105973173281609631859502445945534690830264252230825334468503526193118817101000313783875288658753320838142061717766914730359825349042875546873115956286388235378759375195778185778053217122680661300192787661119590921642019893809525720106545858632788659361533818279682303019520353018529689957736225994138912497217752834791315155748572424541506959508295331168617278558890750983817546374649393192550604009277016711390098488240128583616035637076601047101819429555961989467678374494482553797747268471040475346462080466842590694912933136770289891521047521620569660240580381501935112533824300355876402474964732639141992726042699227967823547816360093417216412199245863150302861829745557067498385054945885869269957690272107975093029553211653449872027559602364806654991198818347977535663698074265425278625518184175746728909777727938000816470600161452491921732172147723501414419735685481613611573525521334757418494684385233239073941433345477624168625189835694855620992192221842725502542568876717904946016534668049886272327917860857843838279679766814541009538837863609506800642251252051173929848960841284886269456042419652850222106611863067442786220391949450471237137869609563643719172874677646575739624138908658326459958133904780275900994657640789512694683983525957098258226205224894077267194782684826014769909026401363944374553050682034962524517493996514314298091906592509372216964615157098583874105978859597729754989301617539284681382686838689427741559918559252459539594310499725246808459872736446958486538367362226260991246080512438843904512441365497627807977156914359977001296160894416948685558484063534220722258284886481584560285060168427394522674676788952521385225499546667278239864565961163548862305774564980355936345681743241125150760694794510965960940252288797108931456691368672287489405601015033086179286809208747609178249385890097149096759852613655497818931297848216829989487226588048575640142704775551323796414515237462343645428584447952658678210511413547357395231134271661021359695362314429524849371871101457654035902799344037420073105785390621983874478084784896833214457138687519435064302184531910484810053706146806749192781911979399520614196634287544406437451237181921799983910159195618146751426912397489409071864942319615679452080951465502252316038819301420937621378559566389377870830390697920773467221825625996615014215030680384477345492026054146659252014974428507325186660021324340881907104863317346496514539057962685610055081066587969981635747363840525714591028970641401109712062804390397595156771577004203378699360072305587631763594218731251471205329281918261861258673215791984148488291644706095752706957220917567116722910981690915280173506712748583222871835209353965725121083579151369882091444210067510334671103141267111369908658516398315019701651511685171437657618351556508849099898599823873455283316355076479185358932261854896321329330898570642046752590709154814165498594616371802709819943099244889575712828905923233260972997120844335732654893823911932597463667305836041428138830320382490375898524374417029132765618093773444030707469211201913020330380197621101100449293215160842444859637669838952286847831235526582131449576857262433441893039686426243410773226978028073189154411010446823252716201052652272111660396665573092547110557853763466820653109896526918620564769312570586356620185581007293606598764861179104533488503461136576867532494416680396265797877185560845529654126654085306143444318586769751456614068007002378776591344017127494704205622305389945613140711270004078547332699390814546646458807972708266830634328587856983052358089330657574067954571637752542021149557615814002501262285941302164715509792592309907965473761255176567513575178296664547791745011299614890304639947132962107340437518957359614589019389713111790429782856475032031986915140287080859904801094121472213179476477262241425485454033215718530614228813758504306332175182979866223717215916077166925474873898665494945011465406284336639379003976926567214638530673609657120918076383271664162748888007869256029022847210403172118608204190004229661711963779213375751149595015660496318629472654736425230817703675159067350235072835405670403867435136222247715891504953098444893330963408780769325993978054193414473774418426312986080998886841326047215695162396586457302163159819319516735381297416772947867242292465436680098067692823828068996400482435403701416314965897940924323789690706977942236250822168895738379862300159377647165122893578601588161755782973523344604281512627203734314653197777416031990665541876397929334419521541341899485444734567383

# Example

Work out the area and circumference of this circle.



# Solution




$$Area = \pi r^2$$

$$= \pi \times 4 \times 4$$

$$= 16\pi \qquad \underline{= \mathbf{50.27cm^2(2d.p.)}}$$

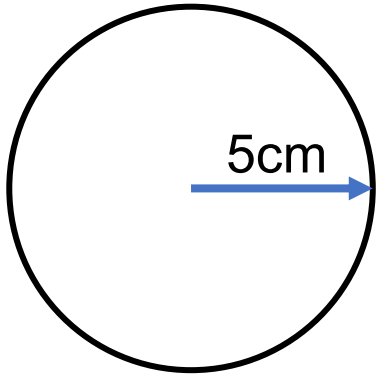
$$\text{Circumference} = \pi \times d$$

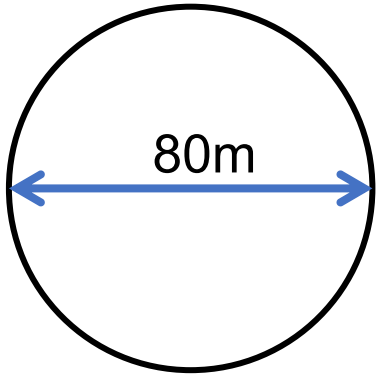
$$= \pi \times 8 \quad \underline{= \mathbf{25.13m(2d.p.)}}$$

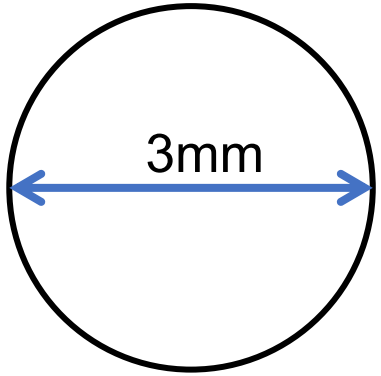
# Exercise

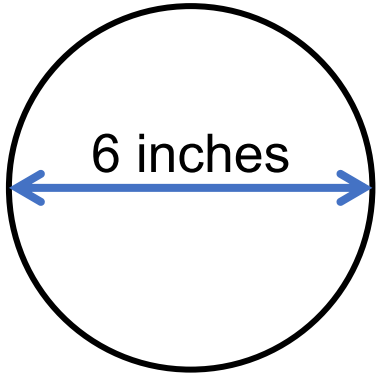
Find the area and circumference of each circle.

Give your answer correct to 2 decimal places:



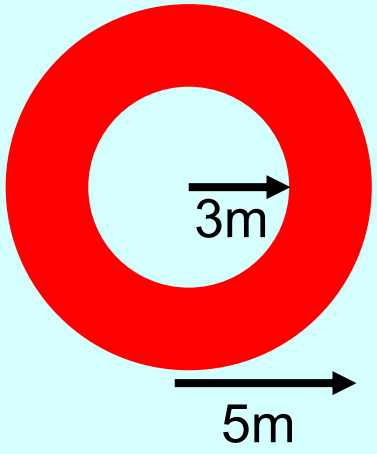




## Challenge

The red shape is called an annulus.

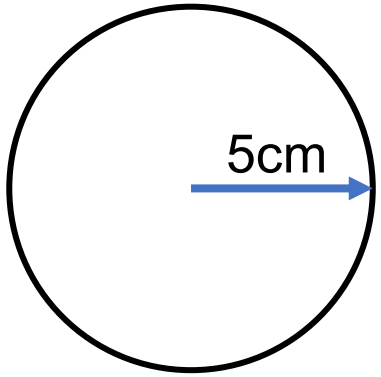
What is its area?



# Solutions

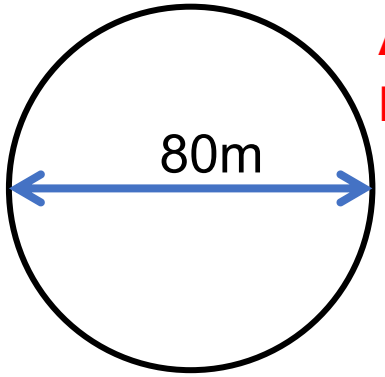
Find the area and perimeter of each circle.

Give your answer correct to 2 decimal places:



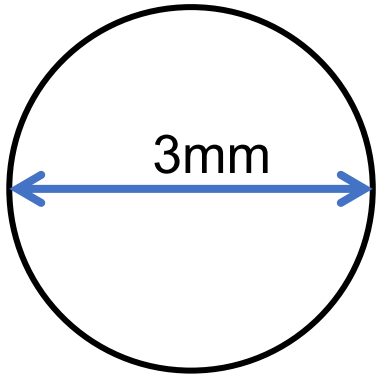

$A = 78.54cm^2$

$P = 31.42\ cm$



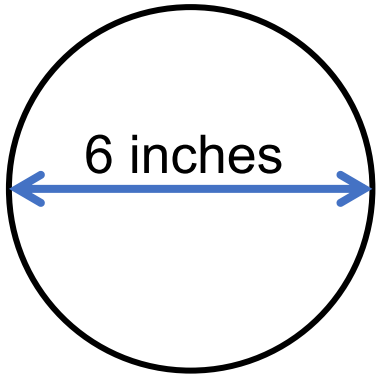

$A = 5026.55m^2$

$P = 251.33\ m$




$A = 7.07mm^2$

$P = 9.42\ mm$



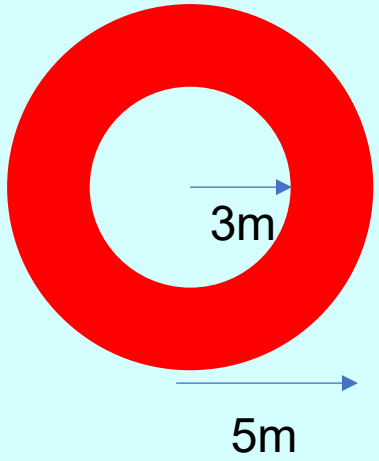

$A = 28.27in^2$

$P = 18.85\ in$

## Challenge

The red shape is called an annulus.

What is its area?




$A = 50.27m^2$

# Further Exercise

Give all answers to 3 significant figures.

1. A circle has a radius of 8 cm. What is the area of the circle?

2. A circle has a radius of 4 m. What is the circumference of the circle?

3. A circle has a circumference of 20 m. What is the radius of the circle?

4. A circle has an area of 40 $cm^2$. What is the diameter of the circle?

5. A circle has a circumference of 500 mm. What is the area of the circle?

6. Draw a circle with a circumference of 30 cm?

7. Draw a circle with an area of 50 000 $mm^2$?

# Solutions

Give all answers to 3 significant figures.

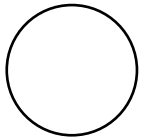
1. A circle has a radius of 8 cm. What is the area of the circle? **201. $cm^2$**

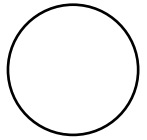
2. A circle has a radius of 4 m. What is the circumference of the circle? **25.1 m**

3. A circle has a circumference of 20 m. What is the radius of the circle? **3.18 m**

4. A circle has an area of 40 $cm^2$. What is the diameter of the circle? **7.14 cm**

5. A circle has a circumference of 500 mm. What is the area of the circle? **19 900 $mm^2$**

6. Draw a circle with a circumference of 30 cm?  **Radius = 4.8 cm**

7. Draw a circle with an area of 50 000 $mm^2$?  **Radius = 126 mm**

Copy and complete the table. Give answers to 1 decimal place.

All measurements are in m

| Radius | Diameter | Circumference | Area |
|---|---|---|---|
| 5 | | | |
| | 12 | | |
| | | 56.5 | |
| | | | 201.1 |
| 0.5 | | | |
| | $\frac{3}{4}$ | | |

# Solutions

| Radius | Diameter | Circumference | Area |
|---|---|---|---|
| 5 | **10** | **31.4** | **78.5** |
| **6** | 12 | **37.7** | **113.1** |
| **9.0** | **18.0** | 56.5 | **254** |
| **8.0** | **16.0** | **50.3** | 201.1 |
| 0.5 | **1** | **3.14** | **0.79** |
| $\frac{3}{8}$ | $\frac{3}{4}$ | **2.36** | **0.44** |

Give your answers to 2 decimal places.

1. A goat is tethered to a vertical pole in a grassy field with a rope. The rope is 3m long. What area of grass can the goat graze.

2. The wheel of a car has radius 42cm. How far does the car travel when the wheel has turned 100 times?

3. The second hand on a clock is 15 cm long.
   How far does the end of the hand travel in one hour?

4. A bicycle wheel has a radius of 30cm. How many revolutions must the wheel make in order to cover 100m?

5. How much larger is the circumference of a circle with radius 2 cm than a circle with radius 1cm.

6. How much larger is the circumference of a circle with radius 201 cm than a circle with radius 200 cm?

7. Is the area of a circle with radius 10cm twice as large as the area of a circle with radius 5cm?

Give your answers to 2 decimal places.

1. A goat is tethered to a vertical pole in a grassy field with a rope. The rope is 3m long. What area of grass can the goat graze. **28.27 $cm^2$**

2. The wheel of a car has radius 42cm. How far does the car travel when the wheel has turned 100 times? **263.89 m**

3. The second hand on a clock is 15 cm long.
   How far does the end of the hand travel in one hour? **56.55 m**

4. A bicycle wheel has a radius of 30cm. How many revolutions must the wheel make to cover 100m? **53.05 m**

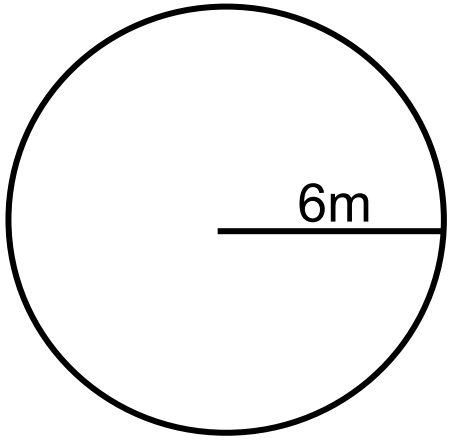
5. How much larger is the circumference of a circle with radius 2 cm than a circle with radius 1cm. **6.28 cm**

6. How much larger is the circumference of a circle with radius 201 cm than a circle with radius 200 cm? **6.28 cm**

7. Is the area of a circle with radius 10cm twice as large as the area of a circle with radius 5cm? **No, 4 times larger**

# Leaving answers in terms of $\pi$

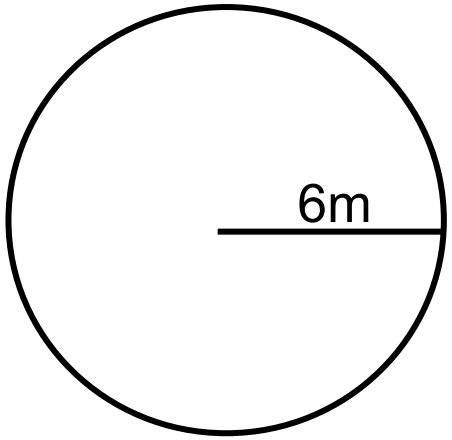
Work out the area and circumference of this circle.
Leave your answer in terms of $\pi$




Why might we leave an answer in terms of $\pi$?

# Solution

Work out the area and circumference of this circle.
Leave your answer in terms of $\pi$




$$Area = \pi r^2$$
$$= \underline{36\pi}$$

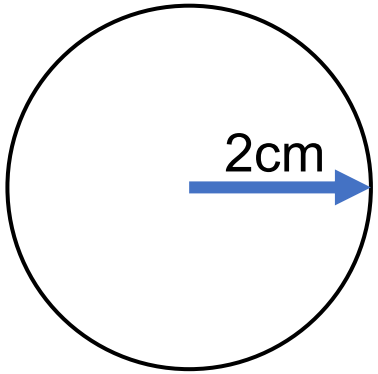
$$\text{Circumference} = \pi \times d$$
$$= \underline{12\pi}$$

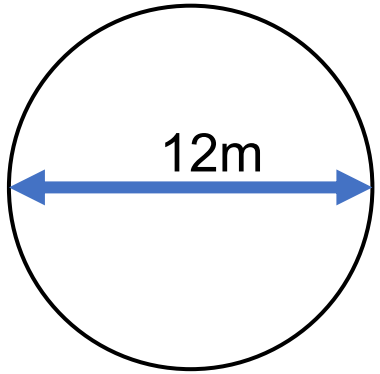
Why might we leave an answer in terms of $\pi$?

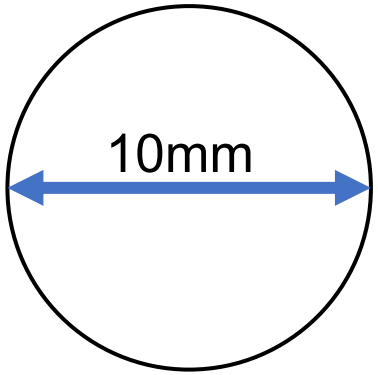
# Exercise

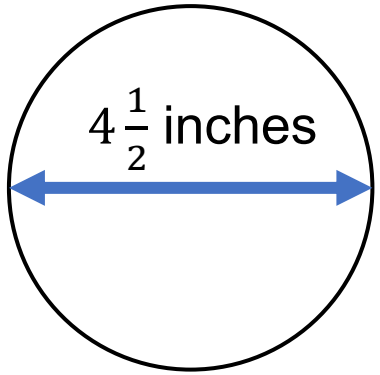
Find the area and circumference of each circle.

Give your answer in terms of $\pi$.



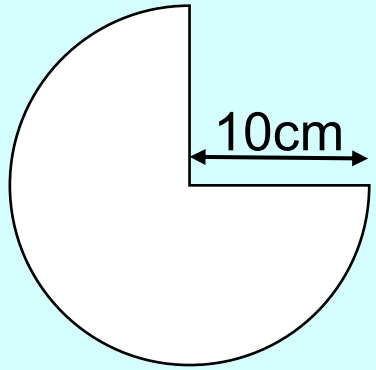




## Challenge

The shape below consists of three quarters of a circle..

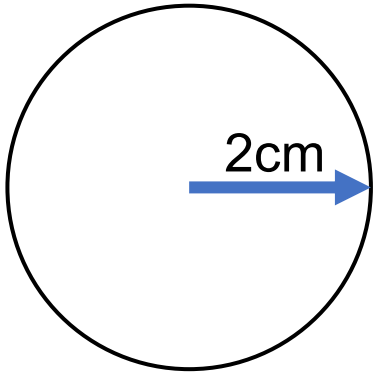
Find the area and perimeter of the shape.



# Solutions

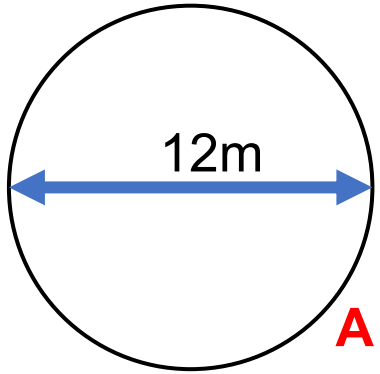
Find the area and circumference of each circle.

Give your answer in terms of $\pi$.



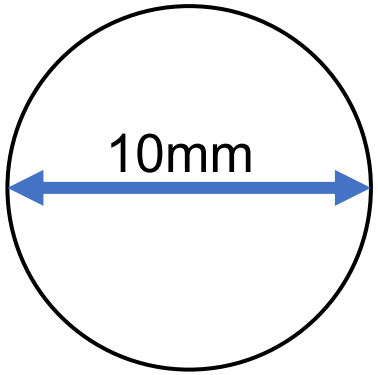

**A = 4π cm²**

**P = 4π cm**



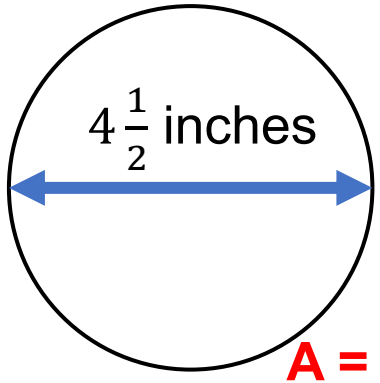

**A = 36π cm²**

**P = 12π cm**




**A = 25π cm²**

**P = 10π cm**



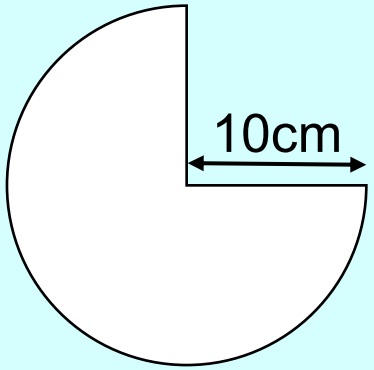

**A = 5.0625π cm²**

**P = 4.5π cm**

## Challenge

The shape below consists of three quarters of a circle..

Find the area and perimeter of the shape.

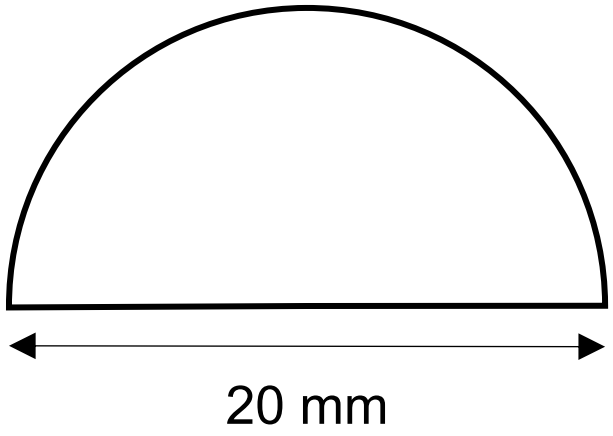



**A = 75π cm²**

**P = 15π + 20 cm**

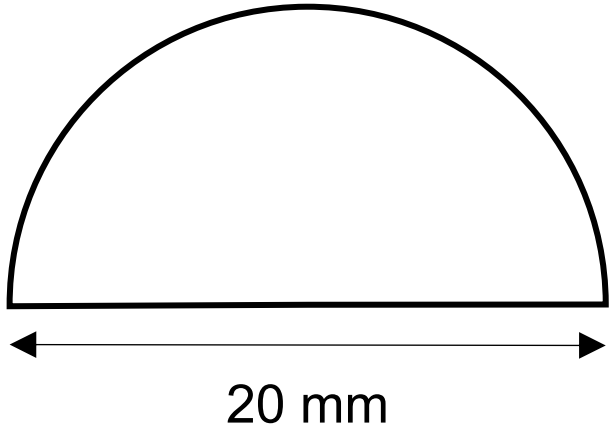
# Compound Shapes : Example

Work out the area and perimeter of this semi-circle.



# Solution

Work out the area and perimeter of this semi-circle.




$$Area = \frac{\pi r^2}{2}$$

$$= \frac{\pi \times 10 \times 10}{2}$$

$$= 50\pi$$

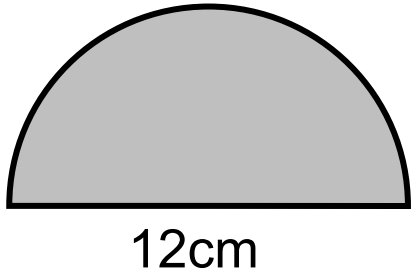
$$= \underline{157.08m^2 (2d.p.)}$$

$$\text{Perimeter} = \frac{\pi d}{2} + 20$$

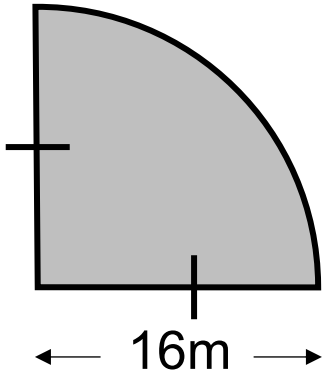
$$= \frac{\pi \times 20}{2} + 20$$

$$= \underline{51.42m\ (2d.p.)}$$

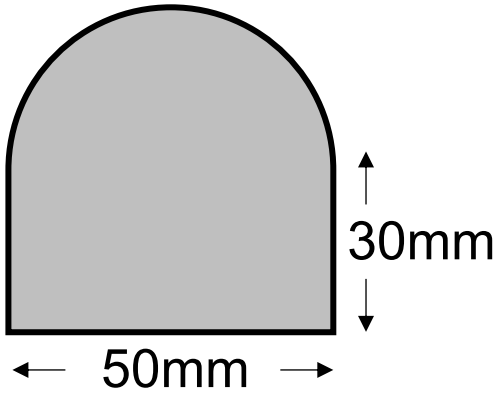
In each question, work out the required quantity.
Give answers to two decimal places.



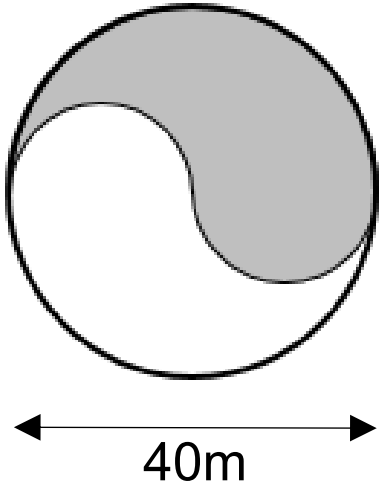

Perimeter =



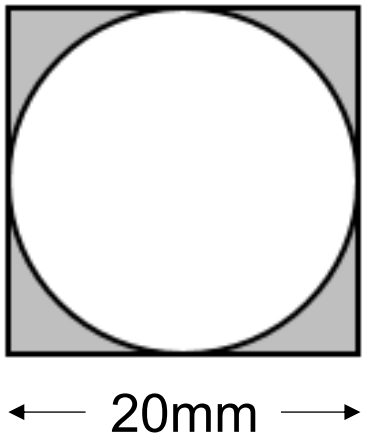

Shaded Area =



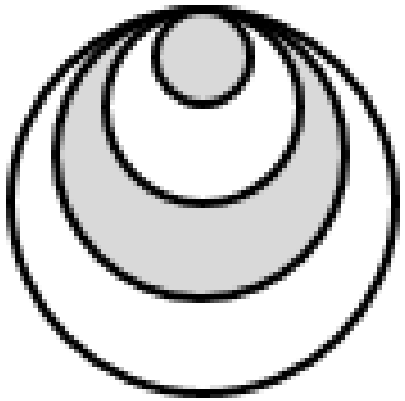

Perimeter =




Shaded Area =



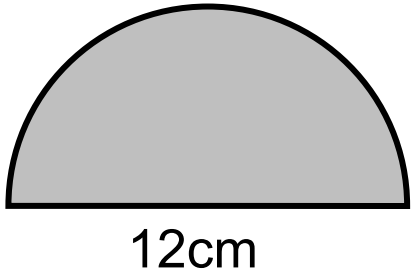

Shaded Area =



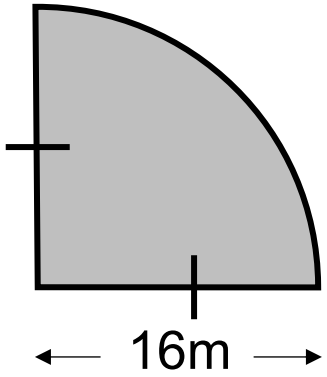
Circles of radius
1, 2, 3, 4 cm

Shaded Area =

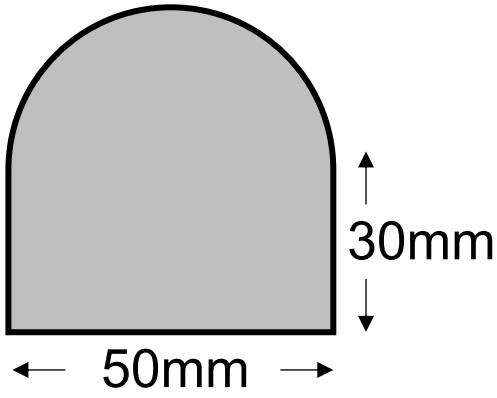
In each question, work out the shaded area.
Give answers to two decimal places.



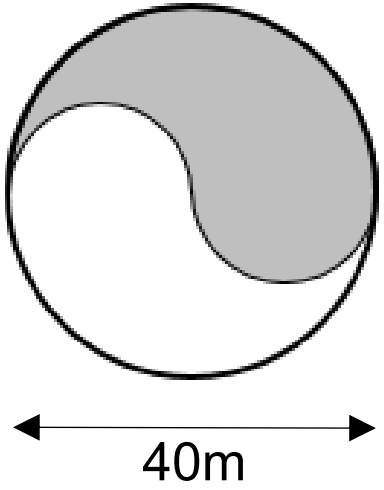

**P = 30.85 cm**



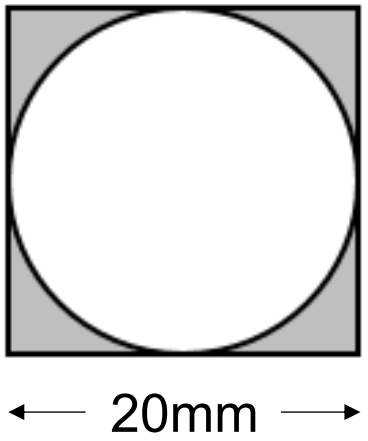

**A = 201.06 m²**



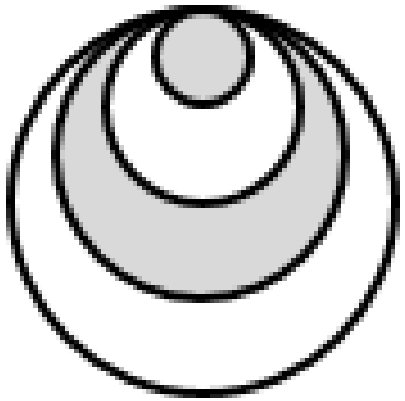

**P = 188.54 mm**




**A = 628.32 m²**




**A = 85.84 mm²**



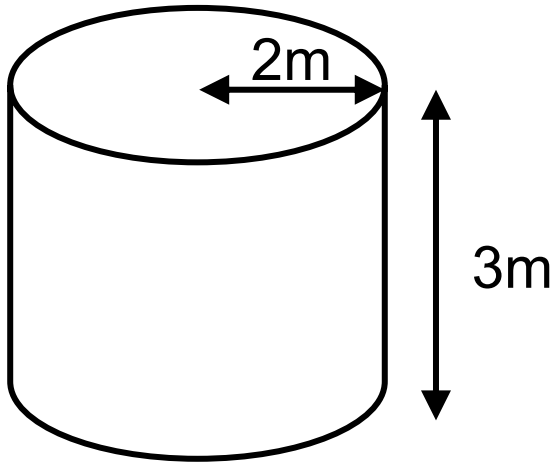
Circles of radius
1, 2, 3, 4 cm

**A = 18.85 cm²**

# Extension

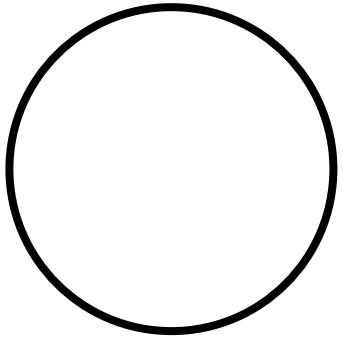
Find the surface area of this cylinder.

Give your answer in terms of $\pi$.



# Solution

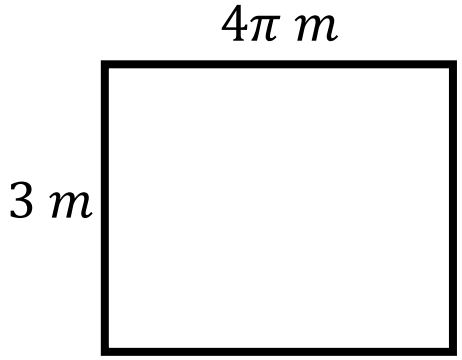
## Circles on top and bottom




$$Area = \pi \times 2 \times 2$$

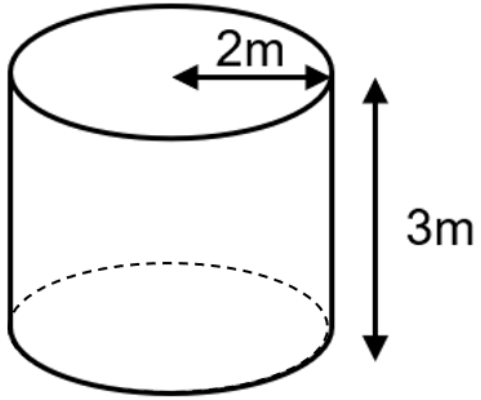
$$4\pi\ m^2$$

## Curved surface area




$$Area = 4\pi \times 3$$

$$= 12\pi\ m^2$$



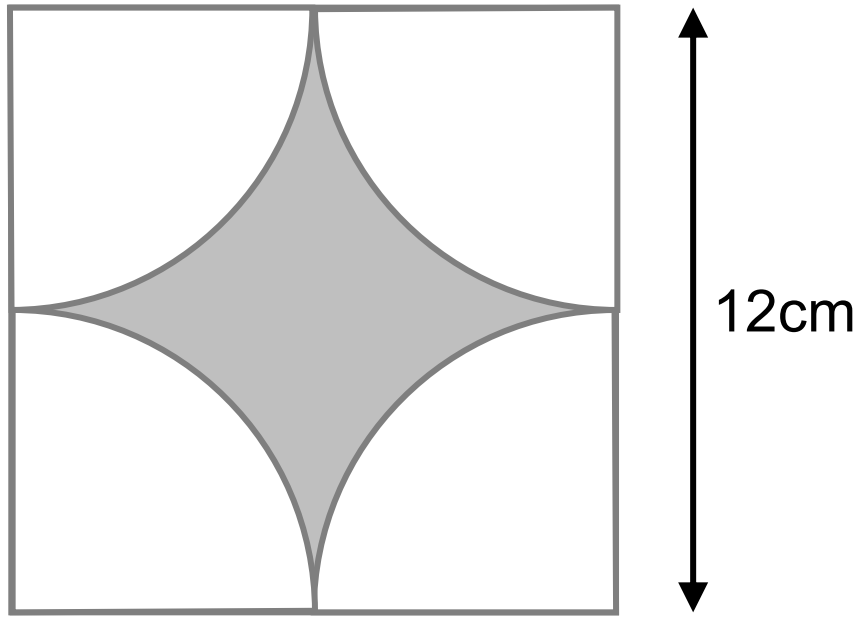

Total surface area = $20\pi$

$= 12\pi + 12\pi + 12\pi$

$= 20\pi\ m^2$

# Exam Style Question

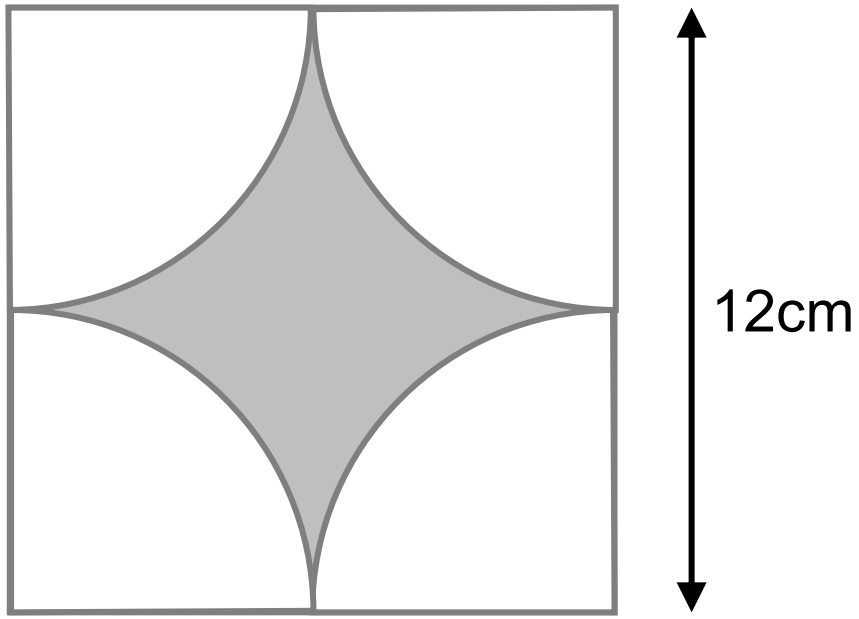
The design below is made by cutting four identical quarter circles from a square.




Work out the shaded area.

# Solution

The design below is made by cutting four identical quarter circles from a square.




Work out the shaded area.

*Area of square = 12 x 12*

*= 144cm²*

*Area of 4 quarter circles*
*= one whole circle* *= π x 6²*

*= 113.10 cm²*

*Shaded area = 144 - 113.10*

*= 30.9cm²*