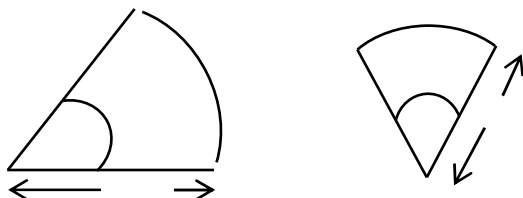


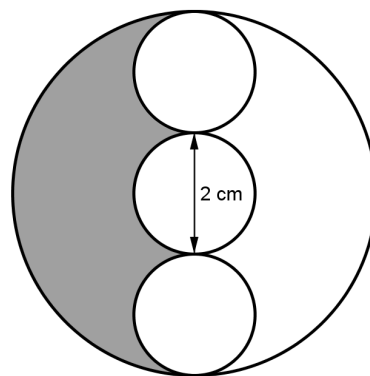
## Foundation Check In – 3.03 Exact calculations

Do not use a calculator.

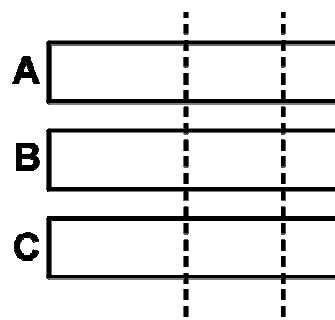
1. Work out the mean of  $\frac{3}{8}$ ,  $\frac{1}{4}$ ,  $\frac{1}{8}$  and  $\frac{7}{8}$ .
2. A giant tortoise travelled  $\frac{2}{9}$  of a mile in 40 minutes. What was the average speed of the giant tortoise in miles per hour?
3. What number is half way between  $\frac{3}{7}$  and  $\frac{5}{9}$ ?
4. A circle of radius 10 cm is split into ten pieces of equal area. What is the exact area of each piece?
5. Simplify  $\frac{2}{3}\pi + 4\pi + 1\frac{1}{6}\pi$ .
6. Show that  $2\frac{1}{2} \times 1\frac{1}{3} \times \frac{3}{4} \times \frac{2}{5} = 1$ .
7. Show that the difference in the area of these two sectors is  $2\pi \text{ cm}^2$ .



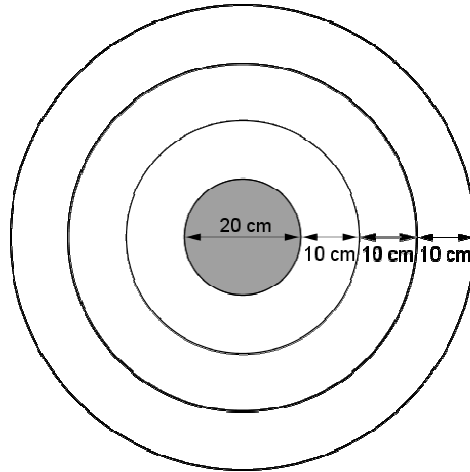
8. The big circle on the right has three circular holes cut out of it. The three holes are congruent and have diameter 2 cm. When the holes are cut, the big circle is split into two parts. Show that the area of the shaded part is  $3\pi \text{ cm}^2$ .



9. The three rectangles on the right are identical in size.  
Rectangle A has  $\frac{4}{5}$  shaded.  
Rectangle C has  $\frac{8}{15}$  shaded.  
Work out the fraction of rectangle B that is shaded.



10. The diagram below shows an archery target that is made up of 4 concentric circles. Calculate the fraction of the total area of the target that is shaded. Give your answer in its simplest form.



## Extension

Unit fractions are fractions whose numerator is equal to 1. For example,  $\frac{1}{8}$  or  $\frac{1}{3}$  are unit fractions.

You can make other fractions by adding together unit fractions. For example,  $\frac{3}{4} = \frac{1}{2} + \frac{1}{4}$

which shows that  $\frac{3}{4}$  can be made by adding two unit fractions.

Can you find ways of making  $\frac{3}{4}$  by adding three **different** unit fractions?



## Answers

1.  $\frac{13}{8} \div 4 = \frac{13}{8} \times \frac{1}{4} = \frac{13}{32}$

2. Speed =  $\frac{2}{9} \div \frac{40}{60} = \frac{2}{9} \times \frac{60}{40} = \frac{2}{9} \times \frac{3}{2} = \frac{1}{3}$  miles per hour.

3.  $\frac{\frac{3}{7} + \frac{5}{9}}{2} = \frac{\frac{27}{63} + \frac{35}{63}}{2} = \frac{62}{2 \times 63} = \frac{62}{63} \times \frac{1}{2} = \frac{31}{63}$

4. Area of whole circle is  $10^2 \times \pi = 100\pi$ , so each piece is  $100\pi \div 10 = 10\pi \text{ cm}^2$ .

5.  $\frac{2}{3}\pi + 4\pi + 1\frac{1}{6}\pi = \frac{4}{6}\pi + \frac{24}{6}\pi + \frac{7}{6}\pi = \frac{35}{6}\pi$  or  $5\frac{5}{6}\pi$

6.  $2\frac{1}{2} \times 1\frac{1}{3} \times \frac{3}{4} \times \frac{2}{5} = \frac{5 \times 4 \times 3 \times 2}{2 \times 3 \times 4 \times 5} = 1$

7.  $\left(\frac{60}{360} \times \pi \times 4^2\right) - \left(\frac{60}{360} \times \pi \times 2^2\right) = \frac{16}{6}\pi - \frac{4}{6}\pi = \frac{12}{6}\pi = 2\pi \text{ cm}^2$

8. The big circle has diameter 6 cm, so radius 3 cm. Its area is  $9\pi \text{ cm}^2$ . Each small circle has radius 1 cm, so area  $\pi \text{ cm}^2$ . After three holes have been cut out of the big circle, the remaining area is  $9\pi - 3\pi = 6\pi \text{ cm}^2$ . The shaded area is half of this i.e.  $3\pi \text{ cm}^2$ .

9. The unshaded area of B is equal to the unshaded areas of A and C added together so the shaded area is  $1 - \left(1 - \frac{4}{5}\right) - \left(1 - \frac{8}{15}\right) = \frac{15}{15} - \frac{3}{15} - \frac{7}{15} = \frac{5}{15} = \frac{1}{3}$ .

Or shaded area of B = shaded area of C - unshaded area of A, so  $\frac{8}{15} - \frac{3}{15} = \frac{5}{15} = \frac{1}{3}$ .

Or shaded area of B = shaded area of A - unshaded area of C, so  $\frac{12}{15} - \frac{7}{15} = \frac{5}{15} = \frac{1}{3}$ .

10. Total area is  $40^2\pi = 1600\pi \text{ cm}^2$ . The inner shaded circle has area  $10^2\pi = 100\pi \text{ cm}^2$ . The shaded ring has area  $30^2\pi - 20^2\pi = 500\pi \text{ cm}^2$ . So the fraction of the target that is shaded is  $\frac{500\pi + 100\pi}{1600\pi} = \frac{600\pi}{1600\pi} = \frac{3}{8}$ .

## Extension

There are three ways of making  $\frac{3}{4}$  by adding together different unit fractions:

$$\frac{3}{4} = \frac{1}{2} + \frac{1}{5} + \frac{1}{20}, \quad \frac{3}{4} = \frac{1}{2} + \frac{1}{6} + \frac{1}{12} \quad \text{and} \quad \frac{3}{4} = \frac{1}{3} + \frac{1}{4} + \frac{1}{6}.$$



# GCSE (9–1) MATHEMATICS

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	Qu.	Topic	R	A	G
AO1	1	Add fractions then divide a fraction by an integer			
AO1	2	Carry out a speed calculation involving fractions			
AO1	3	Find a fraction half way between two fractions			
AO1	4	Use multiples of $\pi$ in an exact calculation of the area of a proportion of a circle			
AO1	5	Simplify an expression involving fractions and $\pi$			
AO2	6	Multiply mixed numbers and simplify			
AO2	7	Use multiples of $\pi$ in an exact calculation involving the areas of two sectors			
AO2	8	Use multiples of $\pi$ in an exact calculation of the area of a proportion of a compound shape involving circles			
AO3	9	Solve a problem involving fractions of rectangles			
AO3	10	Solve a problem involving exact areas of circles			

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