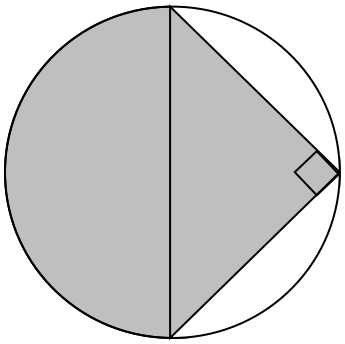
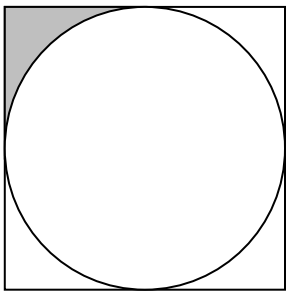
Geometry Challenge!

Find the proportion of each shape shaded. Use a separate A4 piece of paper for your proof of each question, and add these to your folder.

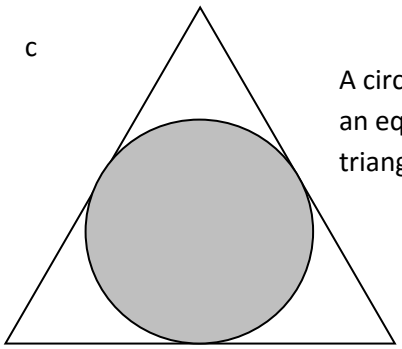
a



b

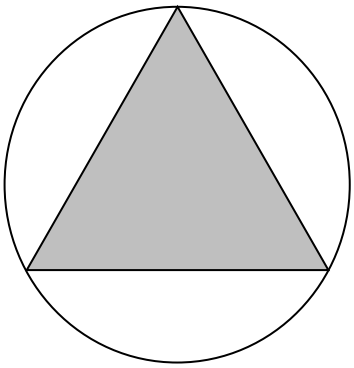


c



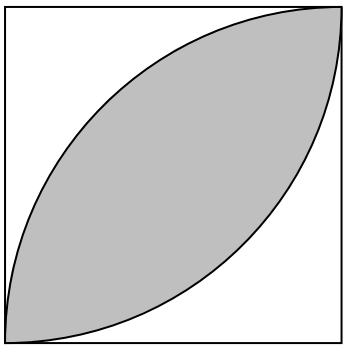
A circle inscribed in an equilateral triangle.

d

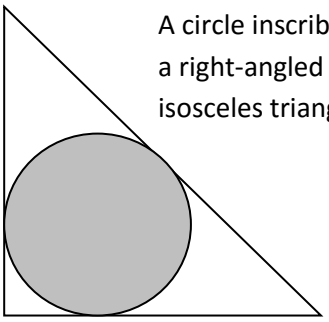


An equilateral triangle inscribed in a circle.

e

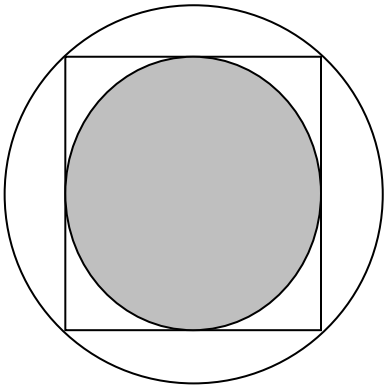


f



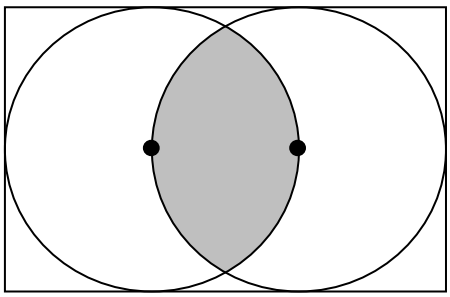
A circle inscribed in a right-angled isosceles triangle.

g



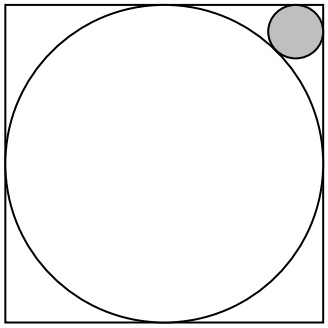
A circle inscribed in a square inscribed in a circle.

h



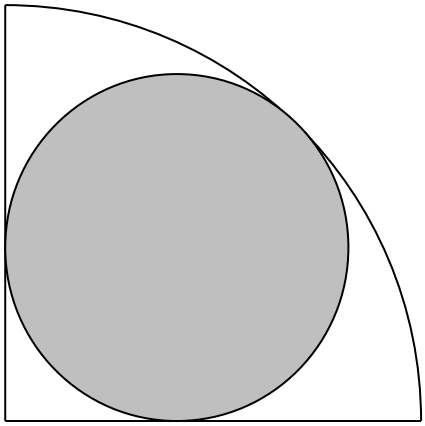
Two circles of equal radius inscribed in a rectangle, overlapping such that the circumference of one circle passes through the centre of the other.

i



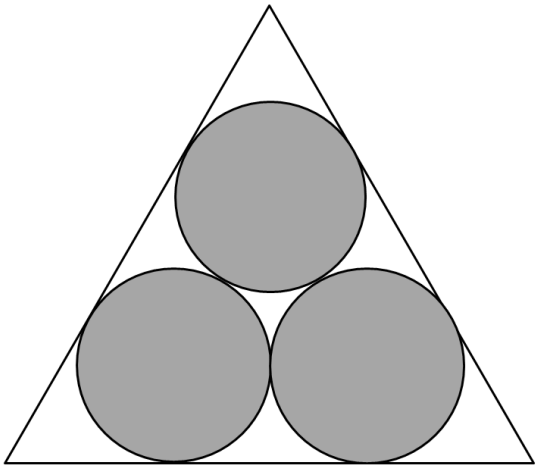
A circle in the gap formed by a larger circle inscribed in a square.

j



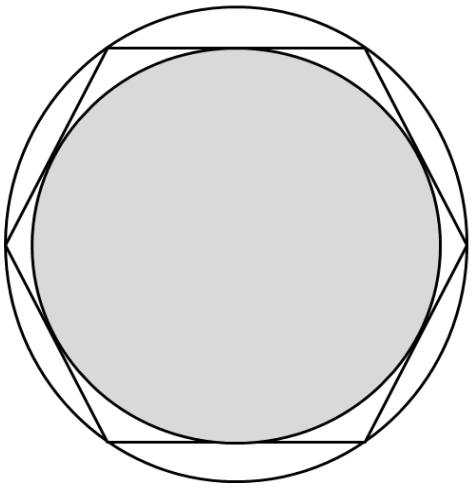
A circle inscribed in a quarter circle.

k



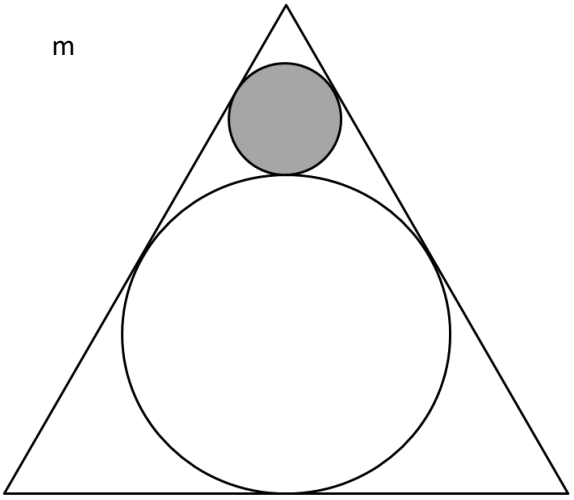
Three circles inscribed in a triangle.

l



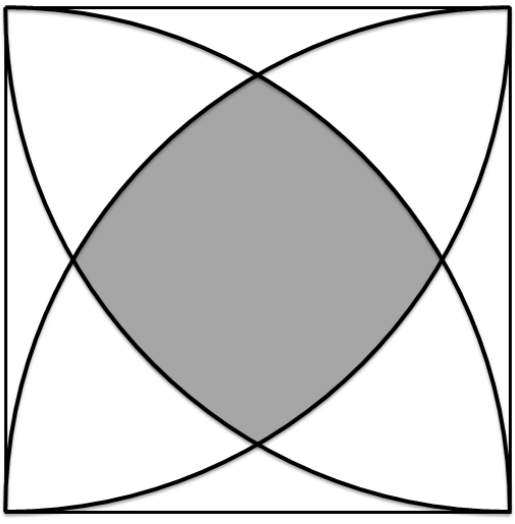
A circle inscribed in a regular hexagon inscribed in a larger circle.

m



A circle in the gap formed by a larger circle inscribed in an equilateral triangle.

n



For this last one, just work out the radius of the small circle when the large circle has radius 1. This one is tough!

ANSWERS

(I'm purposely not providing full solutions here: only the answers!)

a. $\frac{2+\pi}{2\pi}$

b. $\frac{1}{4}-\frac{\pi}{16}$

c. $\frac{\pi}{3\sqrt{3}}=\frac{\pi\sqrt{3}}{9}$

d. $\frac{3\sqrt{3}}{4\pi}$

e. $\frac{\pi}{2}-1$

f. $\frac{\pi}{3+2\sqrt{2}}$

g. $\frac{1}{2}$

h. $\frac{\pi}{9}-\frac{\sqrt{3}}{12}$

i. $\frac{\pi(\sqrt{2}-1)^2}{4(1+\sqrt{2})^2}$

circle be 1, height of triangle is $3+\sqrt{3}$ and base is $2(1+\sqrt{3})$. Thus area of triangle is $6+4\sqrt{3}$ and fraction shaded is $\frac{3\pi}{6+4\sqrt{3}}$.

l. $\frac{3}{4}$

m. $\frac{\pi}{27\sqrt{3}}=\frac{\pi\sqrt{3}}{81}$

n. $\frac{\pi}{3}-\sqrt{3}+1$

☠ The radius of the shaded circle is $\frac{1}{(\sqrt{3}+1)^2}=\frac{1}{4+2\sqrt{3}}$. This would make the proportion of the triangle shaded $\frac{\pi}{12\sqrt{3}+18}$