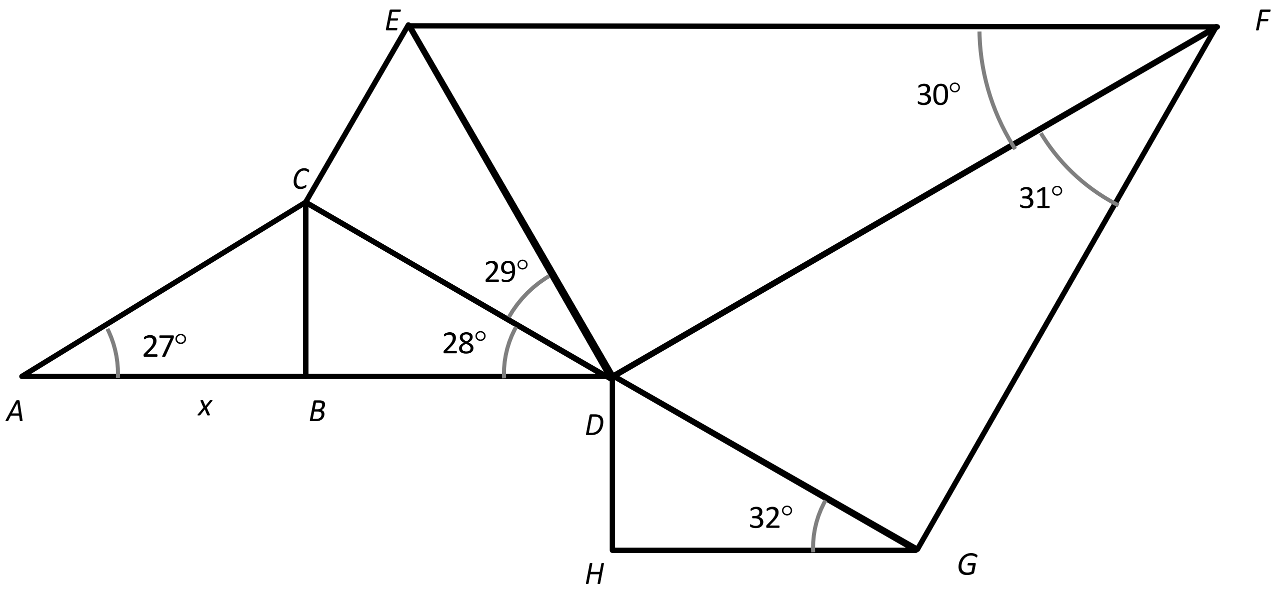
Unit 3 tough revision questions

1. [NOT DRAWN TO SCALE, MOST LINES ARE NOT PARALLEL]

Six **right-angled** triangles are arranged as shown.



(a) The length AB = *x*. Fill in the table, showing the formula defining each length in terms of a previous length, then showing this length as a multiple (to 6 d.p.) of length x. The first one is done for you:

$BC = x\tan(27) = 0.509525x$		
$BD =$	$=$	x
$CD =$	$=$	x
$CE =$	$=$	x
$DE =$	$=$	x
$DF =$	$=$	x
$GF =$	$=$	x
$DG =$	$=$	x
$DH =$	$=$	x
$GH =$	$= 0.938767x$	

Width $\times$ height pairs

(b) Total area = ________________ $\left(\frac{1}{2}x^2\right) =$ x^2

(c) The total area of the six triangles is π^2 square miles. Express x as a multiple of π (to 4 significant figures).

(d) This area is a paddy field (rice farm). The triangles are covered with water. If not replenished, the water level would fall by 1 cm per day through evaporation. What flow rate (litres/second, continuously) is needed to replace the lost water?

(e) Point B is to the East of A. What is the bearing of H from G?

2. Anatolia is a vast plain with roads running straight for many miles. In the centre (our origin, (0,0)) stands a mountain Erciyes Dagi, visible from far away.

An explorer is riding a camel along a straight horizontal road. He has a bubble sextant for measuring angles above the horizon.

- At 9 am he can see the mountain to his East; the elevation of the summit is 9° and he is a distance x (horizontally) from it.
- At 12 am the summit is North-East from his position and at an elevation of 8.7°

(a) What is his horizontal distance from the summit at 12am, as a multiple of x?

(b) His camel is moving at 3 mph. Find x

(c) On what bearing is he heading as he rides down the road?

(d) At what time was/will he be closest to the mountain? What is its elevation then?

(e) He is heading for a castle that is on the road and due South from the mountain. How far horizontally is the castle from the summit?

What time does he get there?

(f) Define an equation for the road (y-axis points Northwards) in the form $y = mx + c$ or $ax + by = c$

3. The line $2x + 3y = 18$ cuts the curve $y = \frac{4}{x}$ at two points. Sketch the curve and the line (roughly). Show that the distance between these points is $\frac{\sqrt{741}}{3}$.

4. A circle of radius 5 m is cut by a straight line $y = -2x + 3$ at points A and B. The distance AB is 6 m.

Another straight line, parallel to the first, cuts the circle at points X and Y such that the distance XY is 2 m.

(a) What line spacings would satisfy this definition? (nb. You do not need to find the centre of the circle or its equation, just sketch it roughly).

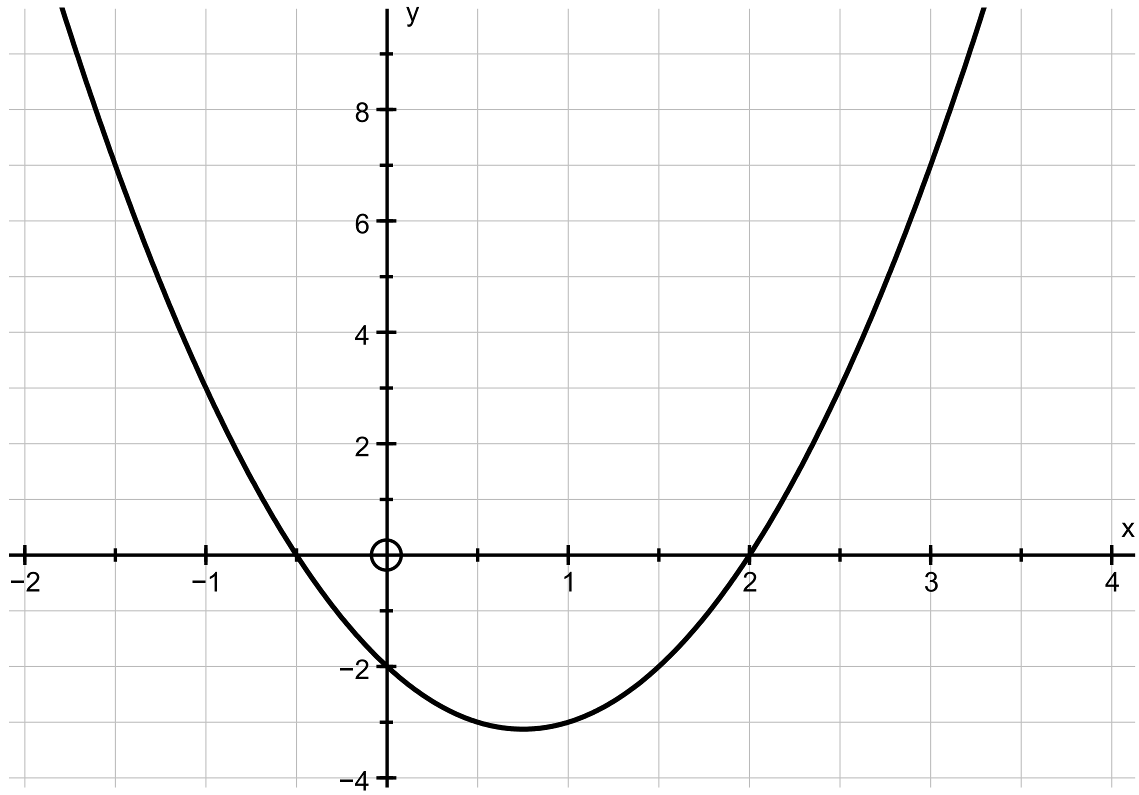
The lines are more than 5 m apart.

(b) Find two possible equations for the second line.

5. The curve $y = 2x^2 - 3x - 2$ is shown below.

(a) Add a straight line to the graph such that the intersection points of the curve and line represent the solutions of $2x^2 - 5x - 4 = 0$, showing the equation of your line.

(b) From the graph, estimate the solutions to the equation.



(c) The curve and the line are now translated 2 units to the right.

Write down:

- the new line equation
- the new curve equation

6. Solve these equations, giving all solutions in the range $0 \le x < 360°$, to 1 decimal place.

(a) $\sin(x+20)=0.8$

(b) $\cos(3x)=0.3$

(c) $\tan(2x+1)=1$

7. Claire, Scott, Tandy and Wayne are on a Duke of Edinburgh's expedition.

(a) Claire says "Last summer I walked 24 miles in 8 hours" (to nearest integer). Write an inequality describing her walking speed.

(b) Scott says "I reckon we have walked at 3 mph for 5 hours" (to nearest integer). What are the upper and lower limits for the distance travelled?

(c) Tandy sees a signpost "Broadway, 5 miles, Bourton 7 miles".

What is the maximum possible distance between Broadway and Bourton?

What is the minimum possible?

(d) Wayne says "Let's hurry, I can walk at 4.0 mph if I take my boots off"

Why does taking his boots off make him walk faster?

What are the upper and lower limits for the time it will take him to reach Broadway?