Section A	**Concepts and Skills**

Question

A computer is going to choose a letter at random from the text of an English novel.
The table shows the probabilities of the computer choosing the various vowels.

Vowel	**A**	**E**	**I**	**O**	**U**
Probability	**0.06**	**0.13**	**0.07**	**0.08**	**0.03**

(a) What is the probability it will **not** choose a vowel?

A = 0·06
E = 0·13
I = 0·07
O = 0·08
U = 0·03
·37

·37 × 100 = 37%

100% − 37 = 63%

Ans = 63%

(b) The probability that the computer will choose the letter **T** is **0.09.**

The computer chooses a letter at random, and then a second, and then a third letter.
What is the probability that these letters will be **E, A** and **T** (in that order)?

E × A × T
0·13 × 0·06 × 0·09 = $\frac{351}{500{,}000}$

$\frac{351}{500{,}000}$ × 100 = ·0702 %

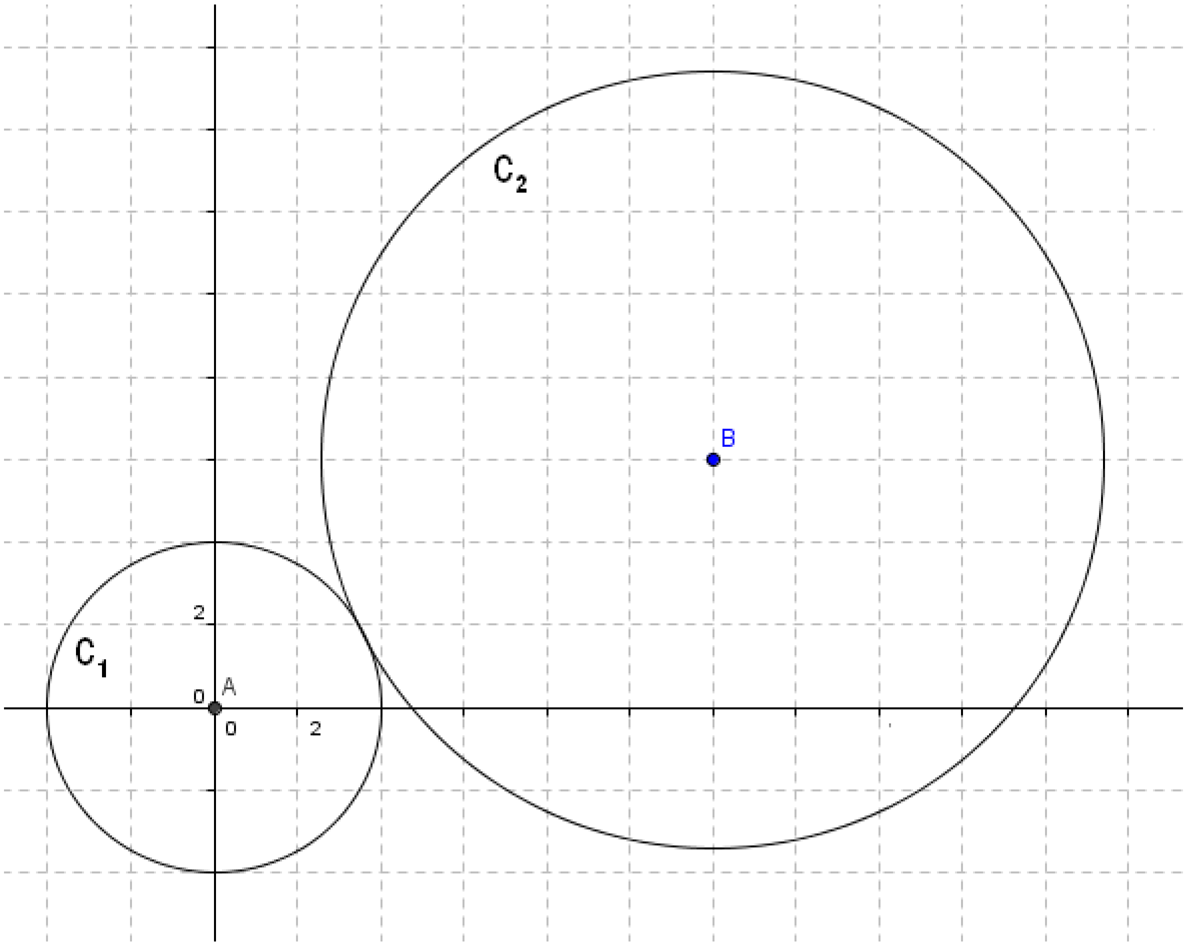
(c) How many ways can these three letters be arranged? Show each arrangement.

EAT
ETA
TEA
TAE
ATE
AET

6 different arrangements.

Question

(a) The diagram shows two touching circles; c_1 and c_2. Using the diagram to estimate the centres and radii as accurately as you can, find the equations of the two circles.



C_1 - $R = 4$, $C = (0,0)$

C_2 - $R = 9.5$, $C = (12,6)$

C_1 $(x-h)^2 + (y-k)^2 = r^2$

$x^2 - 2xh + h^2 + y^2 - 2yk + k^2 = r^2$

$x^2 - 2x(0) + (0)^2 + y^2 - 2y(0) + (0)^2 = 16$

$x^2 + y^2 = 16$

C_2 $x^2 - 2xh + h^2 + y^2 - 2yk + k^2 = r^2$

$x^2 - 2x(12) + (12)^2 + y^2 - 2y(6) + (6)^2 = (9.5)^2$

$x^2 - 24x + 144 + y^2 - 12y + 36 = 90.25$

$x^2 + y^2 - 24x - 12y - 89.75 = 0$

(b) It is claimed that the line with equation $x - y + 6 = 0$ is a tangent to both circles.
By performing suitable calculations, decide whether this claim is true or false.
Explain your answer.

$x = y - 6$ $\quad (y-6)^2 + y^2 = 16$

$y^2 - 12y + 36 + y^2 = 16$

$2y^2 - 12y + 52 = 0$

$y^2 - 6y + 26 = 0$

More than one point of contact → not a tangent

$(x-12)^2 + (y-6)^2 = 90.25$

$(y-6-12)^2 + (y-6)^2 = 90.25$

$(y-18)^2 + (y-6)^2 = 90.25$

$y^2 - 36y + 324 + y^2 - 12y + 36 = 90.25$

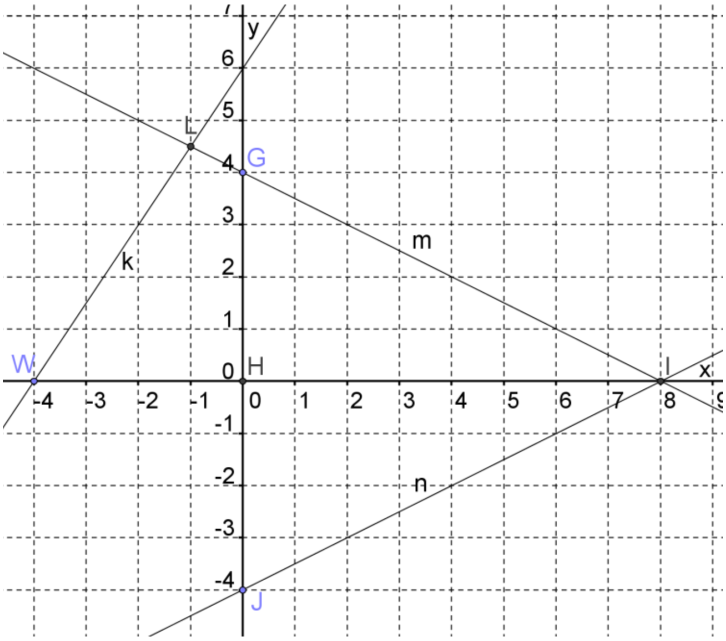
$2y^2 - 48y + 269.75 = 0$ More than one point

$y^2 - 24y + 134.875 = 0$ of contact

Not a tangent

Question

In this diagram state whether each of the following statements is true or false (by placing a ✓ in the appropriate box) and in each case give a reason for your answer.



a) $k \perp m$

True	False
	x

Slope k = $\frac{y_2 - y_1}{x_2 - x_1}$

$y_2 = 6$
$y_1 = 0$
$x_1 = -4$
$x_2 = 0$

$= \frac{6-0}{0-4}$

$= -\frac{6}{4}$

Slope m = $\frac{y_2 - y_1}{x_2 - x_1}$

$y_2 = 4$
$y_1 = 0$
$x_2 = 0$
$x_1 = 8$

$\frac{4-0}{0-8}$

$= -\frac{4}{8}$

b) area ΔGIJ = 32 sq. units

True	False
x	

$\frac{1}{2}$ base × perpendicular height

4 × 8 = 32 sq units

c) the equation of k is $y = -\frac{2}{3}x + 6$

True	False
	x

$y - y_1 = m(x - x_1)$

$y - 0 = -\frac{6}{4}(x - (-4))$

$y = -\frac{6}{4}x - 6$

d) $m \perp n$

True	False
	x

Slope of M = $-\frac{1}{2}$

Slope of n = $\frac{1}{2}$

$\therefore M \not\perp n$

e) the line $y = -2x + 1$ is perpendicular to n

True	False
x	

$m = -2$
Slope $n = \frac{1}{2}$
$-2 \times \frac{1}{2}$
$= -1$

f) the line $y = 2x$ is parallel to m

True	False
	x

$m = 2$
Slope $m = -\frac{1}{2}$

g) ΔGIJ is an isosceles triangle

True	False
x	

$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$
$\sqrt{(0-8)^2+(4-0)^2}$
$\sqrt{64+16} = \sqrt{80}$

$\sqrt{80} = 8.94$

$\sqrt{(0-8)^2+(-4-0)^2}$
$= \sqrt{80}$

$|GJ| = 8$

h) the x-axis is the bisector of $\angle GIJ$

True	False

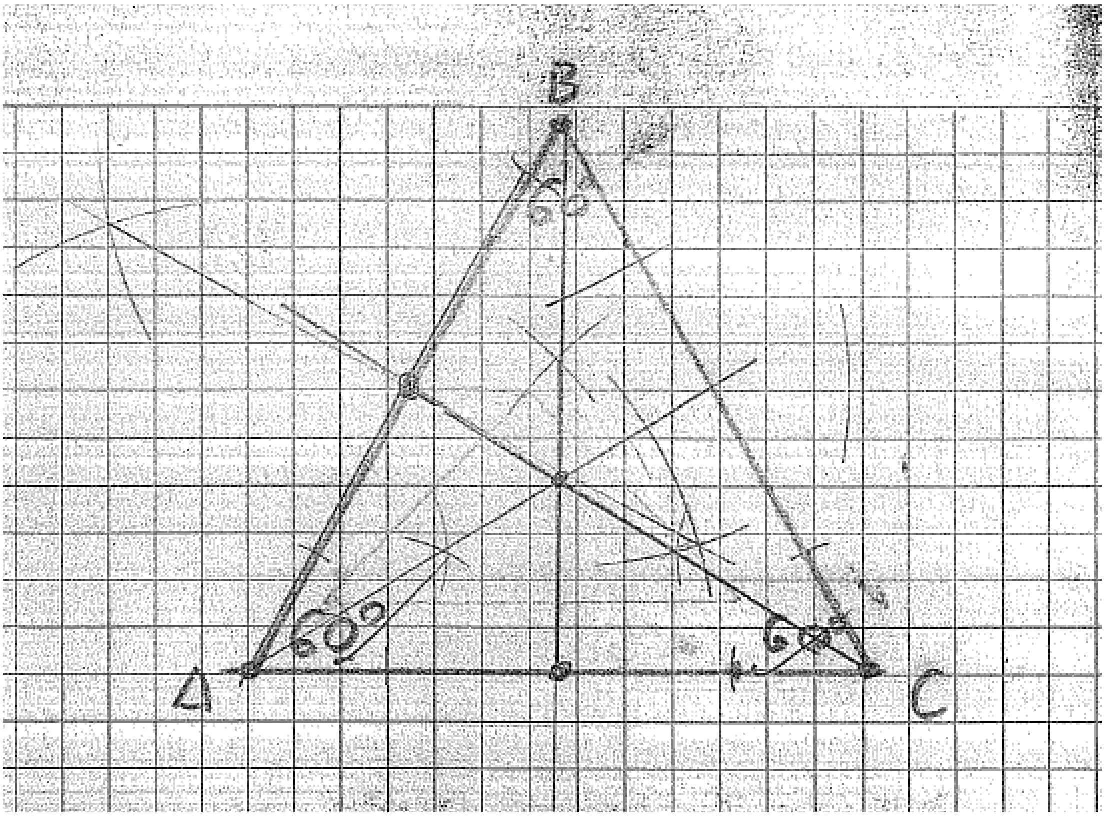
$\tan A = \frac{-4}{8}$ $\tan B = \frac{4}{8}$

$A = B$

$\therefore$ x-axis bisects $\angle GIJ$

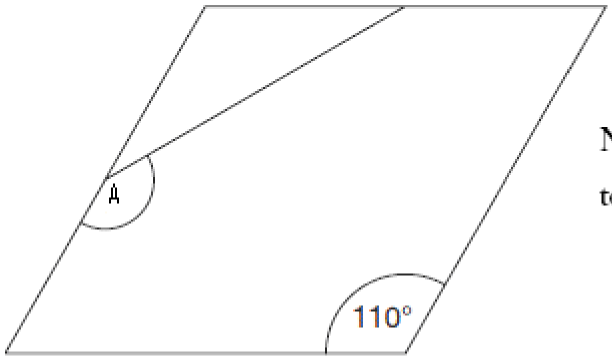
Question

Construct an equilateral triangle. Prove that the inscribed circle and the circumcircle have the same centre.



Question

(a) The diagram shows a rhombus (that is, a parallelogram with four sides of equal length). The midpoints of two of its sides are joined with a straight line segment.



Not drawn to scale.

Calculate the size of angle *A*. Show how you found your answer.

Opposite angles are equal, Angles in a Δ add up to 180°

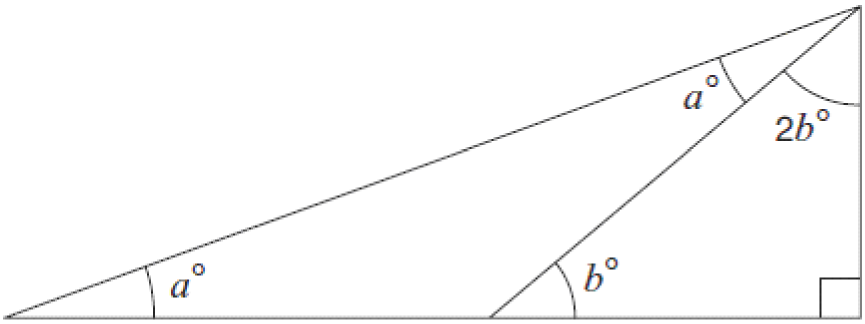
$180 - 110 = 70$

Isosceles triangle so - $70/2 = 35$

$35 + A = 180$ => Straight line = 180°

$A = 145°$

(b)



Not drawn to scale.

Find the value of ***a.*** Show how you found your answer.

$\angle. = 180^\circ - 90^\circ = 90^\circ$

$3b = 90^\circ$

$b = \frac{90^\circ}{3}$

$b = 30^\circ$

Straight line $= 180^\circ - 30^\circ$

$= 150^\circ$

3 angle in triange $= 180^\circ$

$\therefore\ 180^\circ = 150^\circ + 2a$

$180^\circ - 150^\circ = 2a$

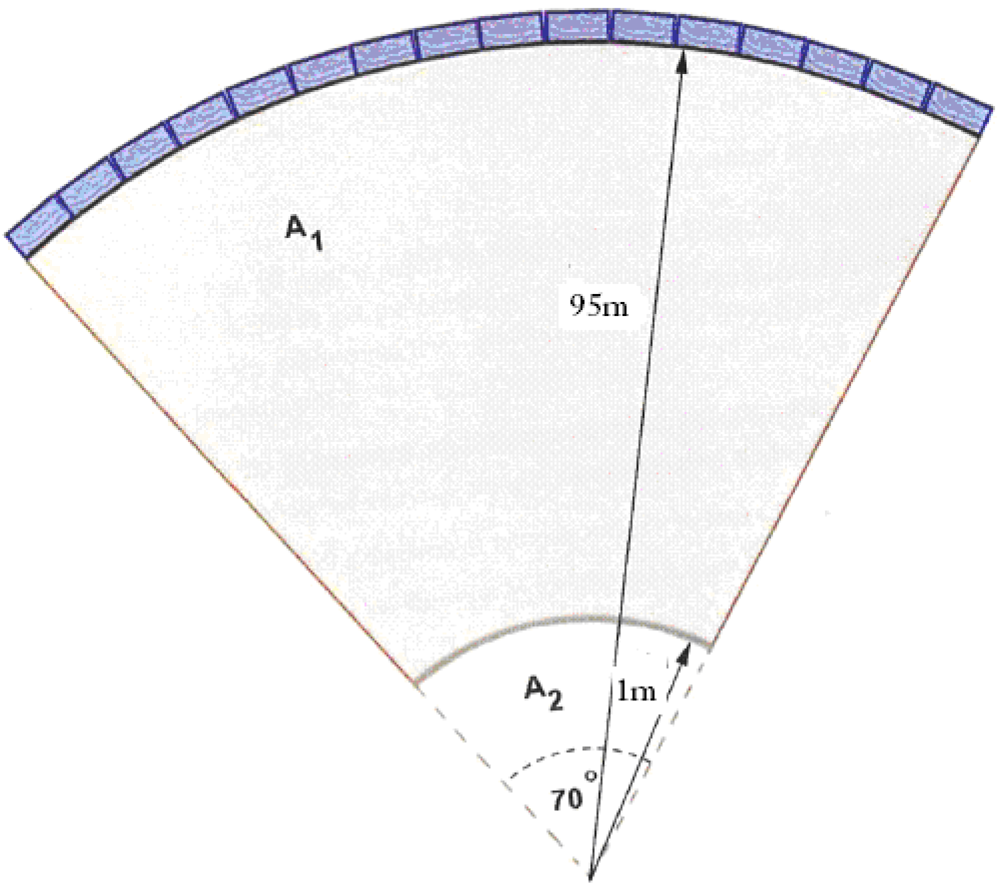
$30^\circ = 2a$

$15^\circ = a$

Section B	Contexts and Applications

Question

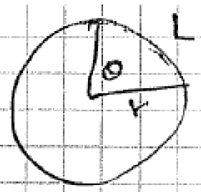
(a) The modern or Olympic *hammer throw* is an athletic throwing event where the object is to throw a heavy metal ball attached to a wire and handle. In the diagram below A_2 represents a portion of the *throwing circle* and A_1 represents the area in which the hammer should land. The diagram is not drawn to scale.



(i) A net is to be erected at the end of the landing area. The foundation consists of a single row of bricks; each brick is 41cm long. How many bricks will be needed to lay the foundations?

(ii) The area A_1 will be planted with grass. A *10kg* bag of lawn seed covers approximately $220m^2$. How many bags of grass seed must be bought?

Show all your work and state any assumptions you make.



$$L = 2\pi r \left[\frac{\theta}{360^\circ}\right]$$

$$L = (2)(\pi)(95)\left[\frac{70^\circ}{360^\circ}\right]$$

cm 11606.4

$L = 116.064$ m

$L = L$

$11606.4 \div 41$

$= 283.08$

284 bags needed

Area of A_1 = $A = \pi r^2 \left[\frac{\theta}{360^\circ}\right]$

$$A = \pi (95)^2 \left[\frac{70^\circ}{360^\circ}\right]$$

$$A = 5513.059$$

Area of A_2 = $A = \pi r^2 \left[\frac{\theta}{360}\right]$

$$A = \pi (1)^2 \left[\frac{70}{360}\right]$$

$$A = .06108$$

10

$A_1 - A_2 = 5513.058 - .06108 = 5512.99 \div 220$

$= 25.059$

Ans = 26 bags

Question

The lengths of the ring fingers of 30 Irish students chosen randomly from amongst those who completed the *censusatschool* phase 9 questionnaire are displayed below. The measurements are in cm.

7.5	8	7	6	7.5
8.3	6.5	8	5	9
7.3	8.5	7	7	9
7.2	6.5	7	10	9
3	4	6.6	6	8
7	8	7	7.5	8.4

(a) Use the data to investigate whether ring finger lengths are normally distributed. Explain your answer.

3	0										
4	0										
5	0										
6	5	5	6	0	0						
7	5	3	2	0	0	0	0	0	0	5	5
8	3	0	5	0	0	0	4				
9	0	0	0								
10	0										

(b) Sharon measured the length of her ring finger and found it to be 11.3cm. Her boyfriend says her finger length is most unusual; Sharon disagrees. By calculating the mean and standard deviation of the distribution above, present evidence to support either Sharon's argument, or that of her boyfriend.

Mean = 7.28

Standard deviation = 1.46

Sharon's ring size is most unusual as it lies between the second and third standard deviation.

Mathematics (Project Maths – Phase 2)

Pre-Leaving Certificate – Ordinary Level Paper 2
February 2011