Credit Mathematics - Practice Examination H

***Please note … the format of this practice examination is the same as the current format. The paper timings are the same, as are the marks allocated.
Calculators may only be used in Paper 2.***

MATHEMATICS
Standard Grade - Credit Level

Paper I

Time allowed - 55 minutes

Read Carefully

1.   Answer as many questions as you can.
2.   Full credit will be given only where the solution contains appropriate working.
3.   **You may not use a calculator**

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$ *or* $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle: Area $= \frac{1}{2}ab\sin C$

Standard Deviation: $s = \sqrt{\dfrac{\sum(x - \bar{x})^2}{n - 1}} = \sqrt{\dfrac{\sum x^2 - \dfrac{(\sum x)^2}{n}}{n - 1}}$

	KU	RE

1. Evaluate $32\cdot5 - 28\cdot04 \div 4$.

2. Evaluate: $\frac{3}{5}$ of $\left(1\frac{1}{3} - \frac{5}{7}\right)$.
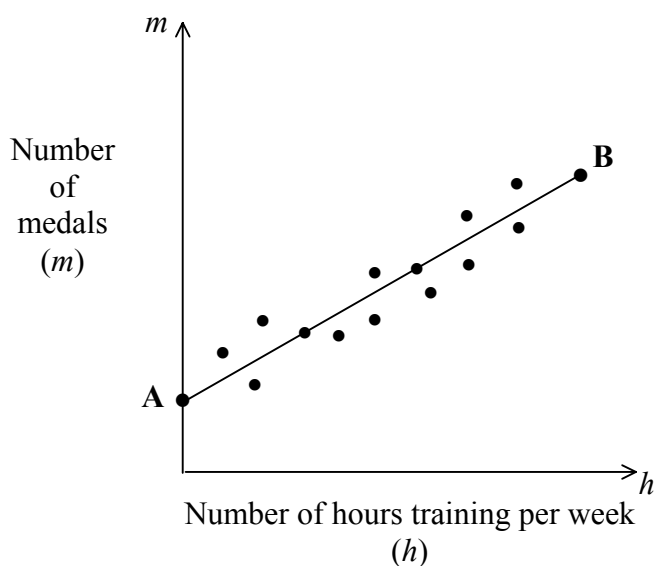
3. The function $f(x)$ is given by the formula $f(x) = 2x^2 - 5$, where x is a real number.

  (a) Find the value of $f(-3)$.

  (b) Find the **values** of a for which $f(a) = 45$.

4. Solve the equation $\dfrac{3x+1}{2} - \dfrac{x+4}{3} = 5$, where x is a real number.

5. The graph below shows the relationship between the number of hours (h) a swimmer trains per week and the number of Championship medals (m) they have won.

A best fitting straight line AB has been drawn.
Swimmer A does not train but has won 3 medals this year.
Swimmer B who trains for 14 hours per week has won 31 medals this year.

  (a) Find the equation of the straight line AB in terms of m and h.

  (b) How many medals would you expect a swimmer who trains 10 hours per week to have won ?

KU marks: 2, 2, 2, 3, 3, 4
RE marks: 1

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6. Uranium is a radioactive isotope which has a half-life of $4 \cdot 5 \times 10^9$ years. This means that only half of the original mass will be radioactive after $4 \cdot 5 \times 10^9$ years.

   How long will it take for the radioactivity of a piece of Uranium to reduce to **one eighth** of its original level? Give your answer in **scientific notation**.

   3

7. The Scottish Tourist Group carried out a survey amongst 500 adults from Great Britain to find out what would influence them most when choosing a holiday.

   The results of the survey are shown in the table below.

Age	Cost	Weather	Amenities	Scenery
30 and under	180	75	28	5
Over 30	90	35	12	75

   (a) What is the probability that any adult chosen at random would have scenery as their main priority when choosing a holiday ?

   1

   (b) A 40 year old adult is chosen at random. What is the probability that the weather is his/her main concern when choosing a holiday ?

   2

   (c) What is the probability that any adult chosen at random **will not** have cost as their main concern when choosing a holiday ?

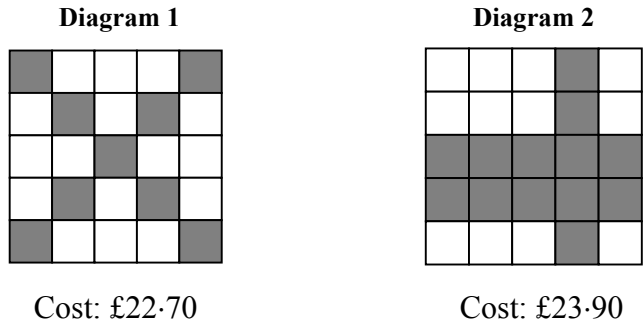   **2**

8. The area of the triangle shown is 30 cm^2.
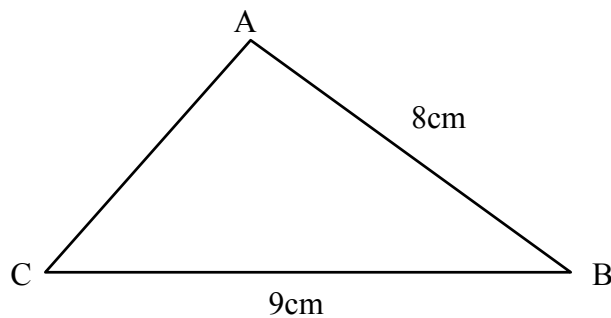


   Show that $\sin B = \frac{5}{6}$.

   4

9. The ground floor vestibule area in a large office block is to be tiled with a mixture of two types of ceramic tile.

The contractors left two samples, with their cost per square metre, as shown in the diagrams below.

Diagram 1

Cost: £22·70

Diagram 2

Cost: £23·90

(a) Using Diagram 1 write down an equation in g and w, where g is the cost of a grey tile and w is the cost of a white tile.

(b) Using Diagram 2 write down a second equation in g and w.

Unfortunately the manager did not like any of the samples left and decided to use one of his own. His choice is shown in the diagram below.
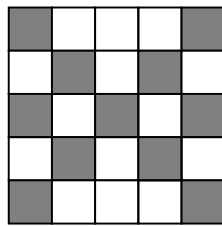
(c) How much per square metre would this design cost ?

KU 1
RE 1

RE 4

10. Sandy found a small photo-frame and decided to put one of her favourite photographs in it. The diagram below shows the dimensions of the frame.

9cm

x cm

12cm

x cm
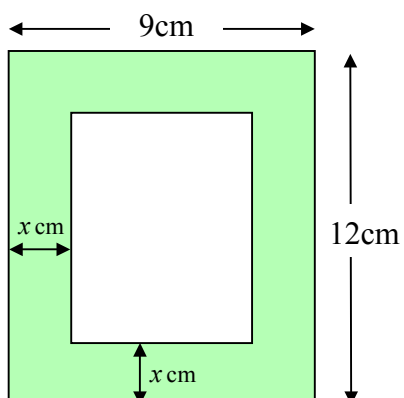
The width of the wooden surround is x cm.

Unfortunately the glass in the centre of the frame was cracked and had to be replaced.

(a) Show that the area of glass needed for the centre of the frame can be given by the formula
$$A = \left(4x^2 - 42x + 108\right) \text{ cm}^2$$

4

(b) If the area of glass needed was 54cm^2, find a possible value for x.

3

[END OF QUESTION PAPER]

Credit Mathematics Practice Exam H   Marking Scheme - Paper 1

	Give 1 mark for each •	Illustration(s) for awarding each mark
1.	**ans : 25·49** **2 KU** • 1 know order of calculations • 2 carry out calculations	 • 1 28·04/4=……. • 2 25·49
2.	**ans: $\dfrac{13}{35}$** **2 KU** • 1 subtract fractions • 2 multiply fractions	 • 1 $1\dfrac{1}{3}-\dfrac{5}{7}=\dfrac{13}{21}$ • 2 $\dfrac{3}{5}\times\dfrac{13}{21}=\dfrac{13}{35}$
3.	**(a) ans: 13** **2 KU** • 1 interpret function notation • 2 evaluate function **(b) ans: -5, 5** **3 KU** • 1 substitute correctly • 2 attempts to solve equation • 3 correctly solves equation	 • 1 $2(-3)^2-5$ • 2 13 • 1 $2a^2-5=45$ • 2 $a=\sqrt{25}$ • 3 $a=\pm 5$
4.	**ans: $x=5$** **3 KU** • 1 subtract fractions • 2 multiply expressions • 3 solve linear equation	 • 1 $\dfrac{3(3x+1)}{2}-\dfrac{2(x+4)}{3}=5$ • 2 $9x+3-2x-8=30$ • 3 $x=5$
5.	**(a) ans: $m=2h+3$** **4 RE** • 1 interpreting information • 2 calculating gradient • 3 identifying y – intercept • 4 correctly stating equation **(b) ans: 23 medals** **1 KU** • 1 sustituting into equation of line	 • 1 Points (0, 3) and (14, 31) • 2 grad $=\dfrac{31-3}{14-0}=2$ • 3 $c=3$ • 4 answer • 1 $m=2(10)+3=23$

	Give 1 mark for each •	**Illustration(s) for awarding each mark**
6.	ans: $1 \cdot 35 \times 10^{10}$ **3 KU** • 1 knowing to multiply by 3 • 2 correctly multiplying • 3 leaving answer in scientific notation	• 1 $3 \times 4 \cdot 5 \times 10^{9}$ • 2 $13 \cdot 5 \times 10^{9}$ • 3 answer
7.	**(a)** ans: $\dfrac{80}{500}\left(\dfrac{4}{25}\right)$ **1 KU** **(b)** ans: $\dfrac{35}{212}$ **2 KU** • 1 knowing to select from 'Over 30' • 2 completing answer **(c)** ans: $\dfrac{230}{500}\left(=\dfrac{23}{50}\right)$ **2 KU** • 1 calculating number **not** concerned • 2 completing answer	• 1 answer • 1 212 as denominator • 2 35 as numerator • 1 500 as denominator • 2 230 as numerator
8.	ans: **Proof** **4 RE** • 1 knowing to use correct formula • 2 substituting correctly • 3 knowing to make $\sin B$ the subject • 4 completing the proof	• 1 Area $= \frac{1}{2}ac\sin B$ • 2 $30 = \frac{1}{2}\times 8 \times 9 \times \sin B$ • 3 & 4 $\sin B = \dfrac{5}{6}$
9.	**(a)** ans: $9g + 16w = 22 \cdot 70$ **1 KU** • 1 stating equation **(b)** ans: $13g + 12w = 23 \cdot 90$ **1 KU** • 1 stating equation **(c)** ans: **£23·30** **4 RE** • 1 knowing to solve equations simultaneously • 2 evaluating one variable • 3 evaluating the second variable • 4 calculating cost	• 1 answer • 1 answer • 1 solving simultaneously • 2 $g = 1 \cdot 10$ • 3 $w = 0 \cdot 80$ • 4 11(1·10) + 14(0·180)=23·30

Give 1 mark for each •	Illustration(s) for awarding each mark
10. (a) ans: **Proof** **4 RE** • 1 finding an expression for length • 2 finding an expression for breadth • 3 calculating area • 4 completing the proof (b) ans: **1·5 cm** **3 KU** • 1 equating expression to 54 • 2 attempting to solve the quadratic equation • 3 correctly solving equation	• 1 $12 - 2x$ • 2 $9 - 2x$ • 3 $A = (12 - 2x)(9 - 2x)$ • 4 answer • 1 $4x^2 - 42x + 54 = 0$ • 2 $2(x - 9)(2x - 3) = 0$ • 3 $x = 1 \cdot 5 \, \text{cm}$

KU - 26   RE - 16   Total 42 marks

Credit Mathematics - Practice Examination H

Please note … the format of this practice examination is the same as the current format. The paper timings are the same, as are the marks allocated.
Calculators may be used in this paper.

MATHEMATICS
Standard Grade   -   Credit Level
Paper II

Time allowed   -   80 minutes

Read Carefully

1.   Answer as many questions as you can.
2.   Full credit will be given only where the solution contains appropriate working.
3.   **You may use a calculator**

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle: Area $= \frac{1}{2}ab \sin C$

Standard Deviation: $s = \sqrt{\dfrac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\dfrac{\sum x^2 - \dfrac{(\sum x)^2}{n}}{n-1}}$

	KU	RE

1. The speed of light is approximately 8×10^5 times faster than the speed of sound in air.

   If the speed of sound in air is 372 metres per second, calculate the speed of light.

   Give your answer in **scientific notation correct to 3 significant figures**.

   KU **2**

2. A farm was put on the market in January 2002.
   The land is extremely fertile and prime for farming so its value has appreciated
   since then by 4·2% per year.
   Unfortunately the farmhouse and outbuildings were in a state of disrepair and have
   depreciated by 3·5% per year.
   The value of the land was £360 000 and the value of the farmhouse along with
   the outbuildings was £135 000 in January 2002.

   What would be the expected value of the complete farm in January 2004 ?

   KU **5**

3. A cat is trapped in a tree and a ladder is placed against the tree in an attempt to rescue it.
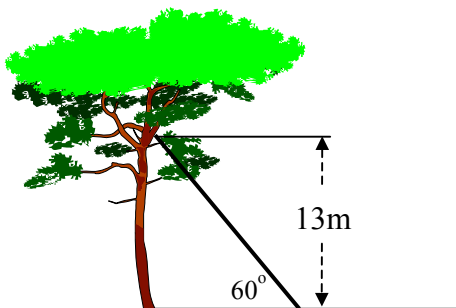
   The ladder rests against the tree making an angle of
   60° with the horizontal and reaching 13 metres up
   the tree, allowing the rescuer to reach the cat.

   13m

   60°

   1m
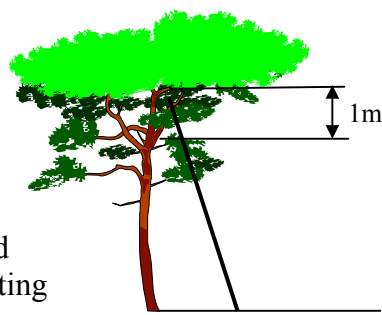
   Unfortunately just as the cat is about to be rescued
   it jumps to a branch 1 metre above its original resting
   place.

   Calculate the size of the angle, to the nearest degree, that the ladder now has to make
   with the horizontal to allow the rescuer to reach the cat.

   RE **5**

4. Solve the equation $x^2 + 4x - 7 = 0$.
   Give your answer **correct to 2 significant figures.**

   KU **4**

5. A group of fifth year students from Scotia High School were asked how many hours studying they did in the week prior to their exams.

The results are shown below.

13   8   10   11   18   9   15

(a) Use an appropriate formula to calculate the mean and standard deviation of these times.

(b) A similar group of students from Scotia Academy were asked the same question

The mean number of hours studied was 14 and the standard deviation was 2·8.

How did the number of hours studied by students from Scotia High School compare with the number of hours studied by students from Scotia Academy ?

6. Rainwater is collected in a rectangular based tank on top of a flat roof and is drained periodically to a cylindrical tank on the ground where it is used for watering plants in dry weather.
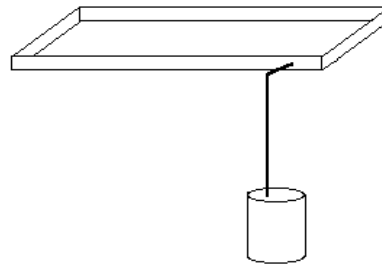
The tank on the roof measures 4 metres by 8 metres and has a depth of 0·2 metres.

The tank on the ground is 1·75 metres high and has base radius of 0·45 metres.

Both tanks were empty, but after a heavy shower all the rainwater from the roof tank was drained to the ground tank and completely filled it.

Calculate the depth of rainwater, to the nearest millimetre, in the roof tank immediately before it was drained to the ground tank.
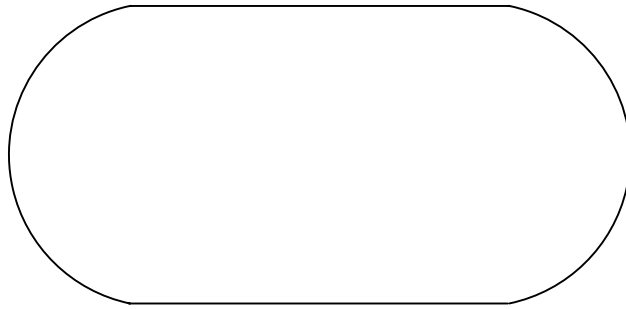
7. The median of five consecutive even integers is $2p + 2$.

(a) Write down, in terms of p , expressions for the five integers.

(b) Show that the mean can be expressed as $2(p + 1)$.
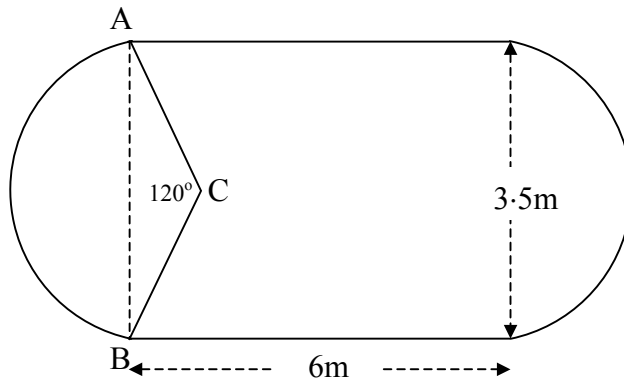
8. A large boardroom table is in the shape of a rectangle with a circle segment at both ends, as shown in the diagram below.

The rectangle at the centre measures 6 metres by 3·5 metres.

AC and BC are radii of the circle and angle ACB is 120°.

(a) Show that AC, the radius of the segment, is 2·02 m correct to 3 significant figures.

(b) To sit comfortably at this table it is estimated that an average person requires 80 cm of table edge.

How many people can sit comfortably at the table described above?

9. The two boxes below are mathematically similar and both have to be wrapped with decorative paper.
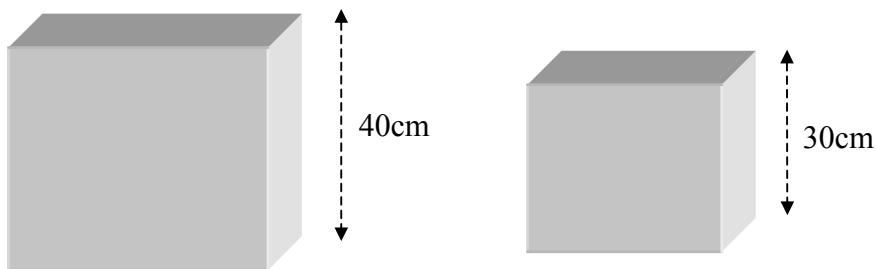
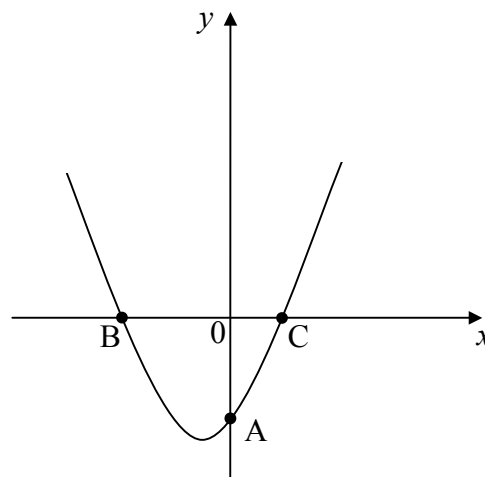If it requires 2·08 m^2 of paper to cover the large box, calculate the amount of paper needed to cover the smaller box.

10. Two boats leave port together. Boat A sails on a course of 052° at 11 miles per hour.
Boat B sails on a bearing of 108° at 14 miles per hour.
After 45 minutes Boat A receives a distress call from Boat B requesting their help
as soon as possible.
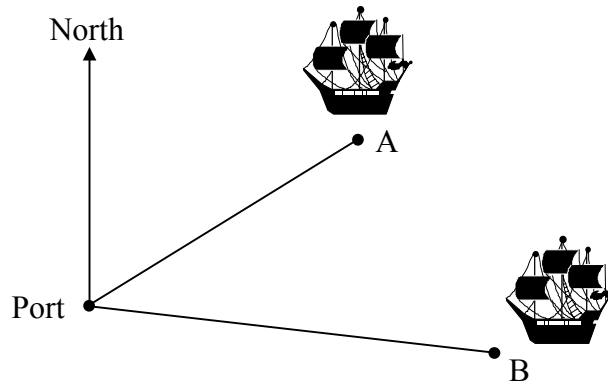
How far, to the nearest mile, would Boat A have to travel to reach Boat B?

4

11. The graph shown has equation $y = x^2 + 3x - 10$.

(a) Find the coordinates of A, the point
where the curve cuts the y – axis.

1

(b) Find the coordinates of B and C,
the points where the curve cuts the
x – axis.

3

(c) Find the coordinates of the minimum
turning point.

2

12. Solve the equation

$5 \tan x^o + 3 = 0$, for $0 \le x \le 360$.

4

[END OF QUESTION PAPER]

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	Give 1 mark for each •	Illustration(s) for awarding each mark
1.	**ans:** $2 \cdot 98 \times 10^8$ **m/sec** **2 KU** • 1 multiplication • 2 answer in scientific notation	 • 1 $372 \times 2 \cdot 98 \times 10^8$ • 2 answer + rounding
2.	**ans : £ 516 590** **5 KU** • 1 for 4.2% increase = 1.042 • 2 for $360000 \times 1 \cdot 042^2$, stated or implied • 3 for 3.5% decrease = 0.965 • 4 for $135000 \times 0 \cdot 965^2$, stated or implied • 5 adding two sums together	 • 1 $1 \cdot 042 \times ......$ • 2 $360000 \times 1 \cdot 042^2 = 390875.04$ • 3 $0 \cdot 965 \times .....$ • 4 $135000 \times 0 \cdot 965^2 = 125715.38$ • 5 390875.04 + 125715.38 (ignore rounding)
3.	**ans: 69^0** **5 RE** • 1 using $\sin 60^o$ • 2 calculating length of ladder • 3 creating R.A.T. with sides 15 and 14 • 4 using $\sin x^o....$ • 5 $x = \sin^{-1}(....)$	 • 1 $\sin 60^o = \dfrac{13}{l}$ • 2 $l = 15$m • 3&4 $\sin x^o = \dfrac{14}{15}$ • 5 answer
4.	**ans : $x = 1 \cdot 3$ or $-5 \cdot 3$** **4 KU** • 1 identifying a, b, c • 2 substituting correctly in formula • 3 calculating one value • 4 calculating second value	 • 1 $a = 1$, $b = 4$, $c = -7$ • 2 $x = \dfrac{-4 \pm \sqrt{4^2 - 4 \times 1 \times (-7)}}{2}$ • 3 $x = 1 \cdot 3$ • 4 $x = -5 \cdot 3$
5.	**(a) ans: $\overline{x} = 12$, sd = $3 \cdot 6$** **3 KU** • 1 calculating mean • 2 calculating $\sum x$ and $\sum x^2$ • 3 calculating standard deviation **(b) ans: Academy had higher mean no. of hours and their times were less spread out.** **2 RE** • 1 comparing means • 2 interpreting s.d. as the idea of spread	 • 1 $\overline{x} = \dfrac{13+8+10+11+18+9+15}{7}$ • 2 $\sum x^2 = 1084$ • 3 s.d. $= \sqrt{\dfrac{1084 - \frac{84^2}{7}}{6}}$ • 1 mean is higher for Scotia Acad • 2 results less spread out for Scotia Acad

	Give 1 mark for each •	Illustration(s) for awarding each mark
6	**ans: 35 mm** **5 RE** • 1 calculating volume of cylinder • 2 calculating volume of cuboid in terms of d, the depth • 3 knowing to equate the two volumes • 4 solving for d • 5 converting to millimetres	• 1 $V_{cyl} = \pi \times 0\cdot45^2 \times 1\cdot75 = 1\cdot113\,\text{m}^3$ • 2 $V_{cuboid} = 4 \times 8 \times d = 32d$ • 3 $32d = 1\cdot113$ • 4 $d = 0\cdot03478$ m • 5 $d = 35$ mm
7.	**(a) ans: $2p-2, 2p, 2p+2, 2p+4, 2p+6$** **2 RE** • 1 indicating a progression of ± 2 • 2 stating sequence **(b) ans: proof** **2 RE** • 1 attempting to calculate mean • 2 completing the proof	• 1 $2p-2, 2p$ • 2 $2p+4, 2p+6$ • 1 $\dfrac{2p-2+2p+2p+2+2p+4+2p+6}{5}$ • 2 $\dfrac{10p+10}{5} = 2(p+1)$
8.	**(a) ans: proof** **3 RE** • 1 creating R.A.T. angle 60^0 and side $1\cdot75$ • 2 using $\sin 60^o$..... • 3 completing proof **(b) ans: 25 people** **4 RE** • 1 knowing how to calculate length of arcs • 2 correctly calculating arcs • 3 calculating perimeter of table • 4 calculating no. of people	• 1 triangle • 2 $\sin 60^o = \dfrac{1\cdot75}{AB}$ • 3 $AB = 2\cdot02\text{m}$ • 1 $\dfrac{120}{360} \times \pi \times 4\cdot04$ (or equivalent) • 2 Arc $AB = 4\cdot229$ m • 3 Perimeter $= 2(4\cdot23) + 2(6) = 20\cdot46\text{m}$ • 4 $20\cdot46 \div 0\cdot8 = 25\cdot58 = 25$
9.	**ans: $1\cdot17\text{m}^2$** **3 KU** • 1 calculating linear scale factor • 2 calculating area scale factor • 3 calculating area of paper	• 1 $\text{linear s.f.} = \dfrac{30}{40} = \dfrac{3}{4}$ • 2 $\text{area s.f.} = \left(\dfrac{3}{4}\right)^2 = \dfrac{9}{16}$ • 3 $\dfrac{9}{16} \times 2\cdot08 = 1\cdot17$

	Give 1 mark for each •	Illustration(s) for awarding each mark

10.	**ans: 9 miles** **4 RE**
	
	• 1 calculating distances using SDT
	• 2 correctly interpreting info.
	• 3 knowing to use Cosine Rule
	• 4 correctly using Cosine Rule.
		• 1 Boat A = 8·25 miles
		          Boat B = 10·5 miles
		• 2&3 $8 \cdot 25^2 + 10 \cdot 5^2$
		          $- 2 \times 8 \cdot 25 \times 10 \cdot 5 \times \cos 56^o$
		• 4 $\sqrt{81 \cdot 4} = 9$ miles
		          (ignore rounding)

11.	**(a)** **ans: (0, -10)** **1 RE** • 1 substitute $x = 0$ **(b)** **ans: B(-5, 0), C(2, 0)** **3 RE** • 1 knowing to equate to 0 and solve • 2 solving correctly • 3 stating coordinates **(c)** **ans: (-1·5, -12·25)** **2 RE** • 1 finding the axis of symmetry • 2 substituting correctly	• 1 $0^2 + 3(0) - 10 = -10$ • 1 $x^2 + 3x - 10 = 0$ • 2 $(x + 5)(x - 2) = 0$ • 3 answer • 1 $x = -1·5$ • 2 $y = -12·25$
12.	**ans: 149°, 329°** **4 KU** • 1 rearranging to find $\tan x^o = ...$ • 2 identifying quadrants • 3&4 calculating angles	• 1 $\tan x^o = -\dfrac{3}{5}$ • 2 2nd and 4th • 3 $x = 149^o$ • 4 $x = 329^o$

KU - 21   **RE - 33**   **Total marks 54**

For PI & PII   **TOTALS KU – 47**   **RE – 49**   **Total marks 96**