Credit Mathematics - Practice Examination A

Please note … the format of this practice examination is different from the current format. The paper timings are different and calculators can be used throughout.

MATHEMATICS
Standard Grade - Credit Level

Time allowed - 2 hours 15 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

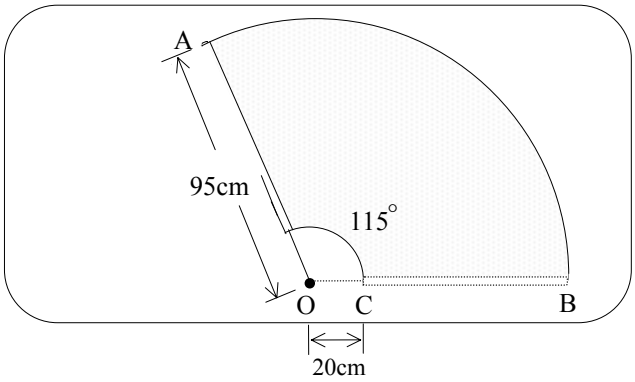
The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{\left(b^2 - 4ac\right)}}{2a}$

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

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

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

	KU	RA
1. Solve the following inequality $3x - 5 \leq 5x + 19$	3	
2. A bus has a single large windscreen wiper as shown below.		



The radius OA = . ' radius OC = 20c·

If the wiper rotates through about O , calculate the area of window cleaned during this sweep. | 4 | |

3. The radius of the earth is $4 \cdot 8 \times 10^6$ metres.

Calculate the surface area of the earth, assuming that the earth is a sphere.

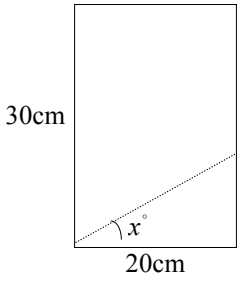
Give your answer in **scientific notation** and in units of **square kilometres** .

[*Surface area of a sphere* $= 4\pi r^2$] | 3 | |

4. A rectangular sheet of paper measures 30cm by 20cm. A cut is made at an angle of x° , as shown, and the triangular piece is removed.

The area of the triangular piece is found to be exactly 20% of the area of the whole sheet.

Find the size of angle x° giving your answer correct to the nearest degree.



		5

	KU	RA

5. A function $f(x)$ is given by $f(x) = 2x + 3$

(a) Find the value of *i)* $f(5)$ *ii)* $f(10)$. **2**

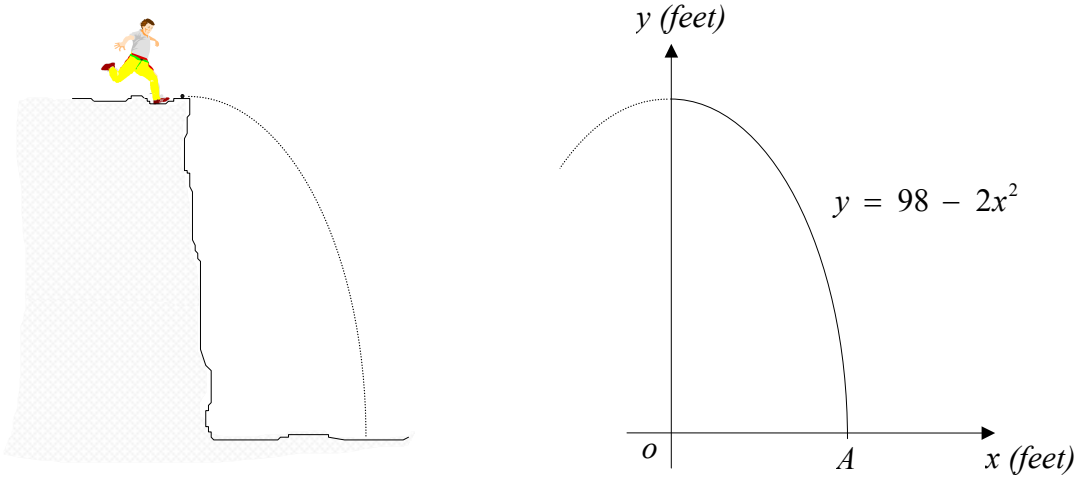
(b) Show that for any value of t , $f(2t) = 2f(t) - 3$ **3**

6. *(a)* Solve the quadratic equation $3x^2 + 4x - 5 = 0$, giving your answer correct to one decimal place. **5**

(b) *i)* Factorise $2x^2 - 7x - 4$. **1**

ii) Hence, simplify $\dfrac{2x^2 - 7x - 4}{4x + 2}$. **2**

7. A boy kicks a stone off a cliff. The path of the stone as it falls is part of a parabola whose equation is $y = 98 - 2x^2$.



(a) Given that the boy is standing at the maximum turning point of the parabola, find the height of the cliff. **2**

(b) The stone lands at the point A . By establishing the coordinates of A , or otherwise, calculate how far out from the bottom of the cliff the stone lands. **3**

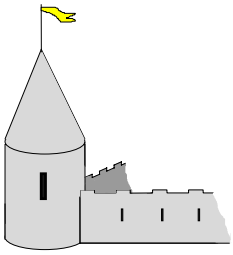
	KU	RA

8. The time, T minutes , to whitewash a square wall varies directly as the square of the side of the wall, W metres , and inversely as the breadth, b centimetres , of the whitewash brush.

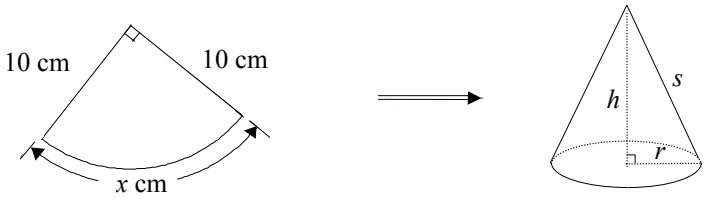
(a) The painter takes 40 minutes to whitewash a certain wall.
How long would it have taken him if his brush had been **twice** as broad as the one he actually used ? **2**

(b) The next wall to be painted has a side which is 50% broader than the first wall.
Using his original (smaller) brush, how long should it take him to whitewash this second wall ? **3**

9. A toy manufacturer makes a range of small castles for children .



The basic turret is conical in shape. It is made by folding a quarter - circle of flexible plastic sheeting into a cone , as shown in the diagram below .



(a) Find x , the arc length of the quarter - circle .
Give your answer in centimetres , correct to one decimal place. **2**

(b) The arc length , x centimetres , becomes the circumference of the base of the cone . Find r , the radius of this base circle in centimetres . **3**

(c) Calculate the volume of this cone in cubic centimetres . **5**

$$Volume\ of\ a\ cone\ = \tfrac{1}{3}\pi r^2 h$$

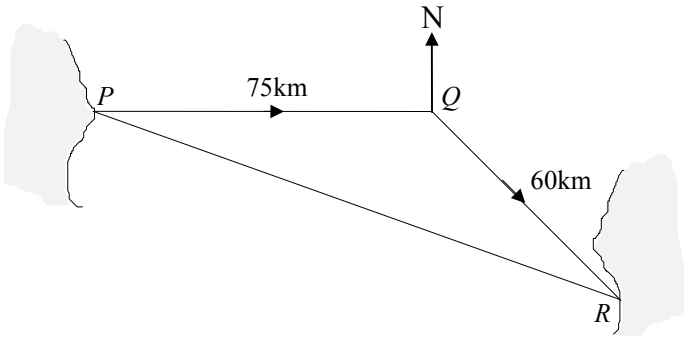
10. The magnetic force, F, of a particle in a magnetic field is given by the formula

$$F = \frac{mv^2}{r} \quad .$$

Make v the subject of the formula. **3**

	KU	RA

11. A ship sails from port P and sails due east to an oil rig Q , 75km away. After delivering its cargo, it sails on a bearing of 120° for 60km until it reaches its destination, port R .



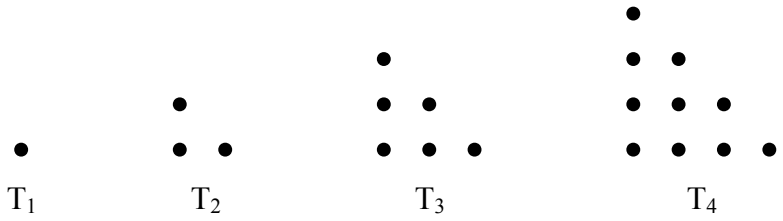
(a) Write down the size of angle PQR . **1**

(b) Calculate the distance between the ports P and R .

Do not use a scale drawing **5**

12. The sequence known as triangular numbers begins as follows : 1 , 3 , 6 , 10 , ...

They can be represented in diagram form as shown below



(a) How many dots will there be in T_6 ? **1**

(b) The formula for the number of dots , D , in the n^{th} triangular number is given by the formula

$$D = \tfrac{1}{2}n^2 + \tfrac{1}{2}n \ .$$

78 dots are required for a certain triangular number T_n . Calculate n . **3**

13. Solve **algebraically** the equation

$$7\cos x^\circ + 5 = 0 \quad , \quad \text{for} \quad 0 \le x < 360 \ . \qquad \textbf{3}$$

	KU	RA

14. A 3 - digit number , pqr , has the value $100p + 10q + r$.

For example ..... $563 = (100 \times 5) + (10 \times 6) + 3$.

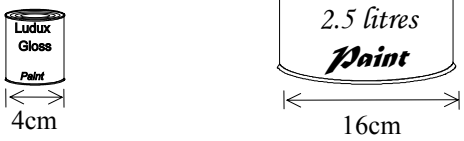
(a) Write down the value of rqp . **1**

(b) Consider the following subtractions which involve a number and its **'reverse'** .

$$321 - 123 = 198$$
$$432 - 234 = 198$$
$$543 - 345 = 198$$

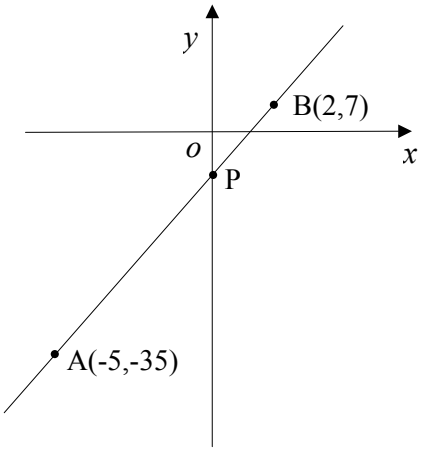
Show that, if you start with any three digit number in the form pqr , where $q = r + 1$ and $p = r + 2$, then when you subtract its **'reverse'** number from it, the answer is always 198 . **4**

15. A small ' sampler ' tin of Ludux paint is similar in shape to the larger $2 \cdot 5$ litre tin.



If the diameters of the sampler and the larger tin are 4cm and 16cm respectively, how many **millilitres** will the sampler tin contain ? **4**

16. All straight lines are in the form $y = mx + c$, where m and c are numbers. Consider the diagram below

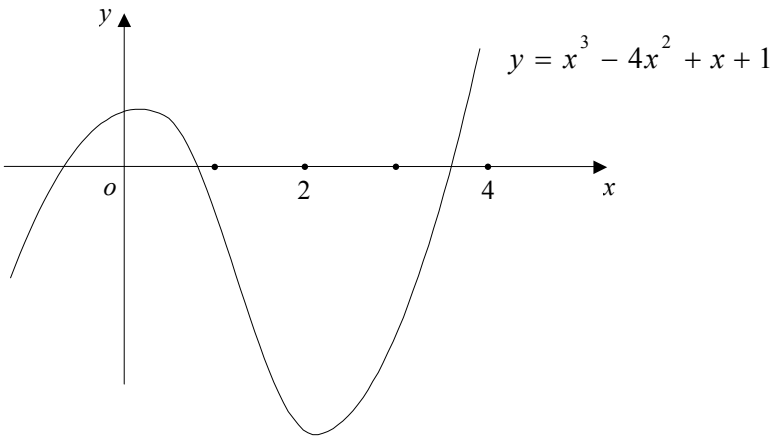


(a) Given that the coordinates of A and B are (-5,-35) and (2,7) respectively, form a system of equations and then solve it to find the values of m and c . **5**

(b) Hence, or otherwise, write down the coordinates of the point P . **1**

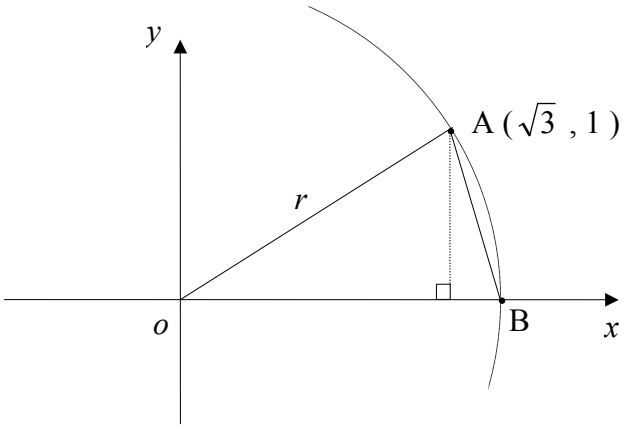
	KU	RA

17. The graph of $y = x^3 - 4x^2 + x + 1$ has a root between 3 and 4 .



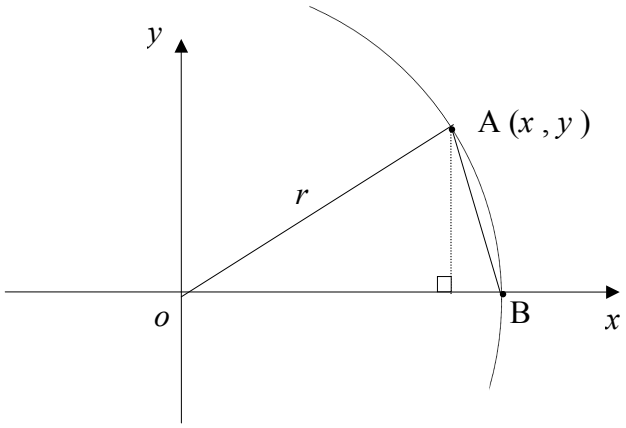
Use iteration to find this root correct to one decimal place. **Show clearly all your working.** **3**

18. The point A ($\sqrt{3}$, 1) lies on a circle centre the origin and radius r as shown in the diagram below.



(a) Show that $r = 2$ and hence that the area of triangle OAB is 1 square unit. **4**

Consider the diagram below for any point A (x , y) in the first quadrant.



(b) Show that, if (x , y) is any point on the circumference of the circle, centre O and radius r , then the area (A) of the triangle OAB is given by the formula

$$A = \tfrac{1}{2} y \sqrt{x^2 + y^2} \quad .$$

3

Credit Mathematics - Practice Exam A **Marking Scheme**

1. For $-24 \le 2x$ ..... (2)
   $x \ge -12$ (or equiv.) ..... (1) **[3 marks KU]**

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2. For using $\frac{115}{360}$ ..... (1)
   For $A_{\text{larger sector}} = 9052 \cdot 6$ sq. cm ..... (1)
   For $A_{\text{small sector}} = 401 \cdot 2$ sq. cm ..... (1)
   For shaded area $= 9052 \cdot 6 - 401 \cdot 2 = 8651 \cdot 4$ sq. cm ..... (1)

   (N.B. i) Ignore rounding errors ii) For consistent use of $C = 2\pi r$, instead of $A = \pi r^2$, ¾ marks) **[4 marks KU]**

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3. For $radius = 4 \cdot 8 \times 10^3 \ km$ ..... (1)
   $S.A. = 289 \cdot 4 \times 10^6$ ..... (1)
   $= 2 \cdot 894 \times 10^8 \ sq. km$ ..... (1) **[3 marks KU]**

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4. For Rect. Area = 600 sq. cm and Tria. Area = 120 sq. cm ..... (1)
   For $Area_{\Delta} = \frac{1}{2} \times 20 \times h = 120$ ..... (1)
   For $h = 12$ ..... (1)
   For $Tan\ x = \frac{12}{20}$ ..... (1)
   For answer $x = 31^\circ$ (accept $30 \cdot 9^\circ$) ..... (1) **[*5 marks RA*]**

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5. (a) i) $f(5) = 13$ ii) $f(10) = 23$ ..... (2) **[2 marks KU]**

   (b) For $f(2t) = 2(2t) + 3 = 4t + 3$ ..... (1)
   For $2f(t) - 3 = 2(2t+3) - 3$ ..... (1)
   $= 4t + 3$ ..... (1)
   (Other proofs of course are acceptable, however, no marks for a series of examples i.e. $f(1)$ and $f(2)$ considered , then $f(2)$ and $f(4)$ etc.) **[*3 marks RA*]**

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6. (a) For $a = 3$, $b = 4$ *and* $c = -5$ ..... (1)
   For $x = \frac{-4 \pm \sqrt{4^2 - (4 \times 3 \times -5)}}{6}$ ..... (1)
   For correct square root number i.e. $\sqrt{76}$ ..... (1)
   For calculation to $x = 0 \cdot 78.....$ *or* $-2 \cdot 11.....$ ..... (1)
   For rounding $x = 0 \cdot 8$ *or* $-2 \cdot 1$ ..... (1)

   (b) i) For $(2x+1)(x-4)$ ..... (1)
   ii) For $\frac{(2x+1)(x-4)}{2(2x+1)}$ ..... (1)
   For cancelling to $\frac{x-4}{2}$ ..... (1) **[8 marks KU]**

7. (a) Maximum occurs at $x = 0$ (stated or implied) ..... (1)
For @ $x = 0$ then $y = 98$ feet ..... (1)

(b) At A , $y = 0$ $\therefore$ $0 = 98 - 2x^2$ ..... (1)
For $x^2 = 49$ ..... (1)
$x = 7$ ..... (1)

(if a is calculated then given as (7,0), full marks) **[*5 marks RA*]**

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8. (a) Knowing what *inverse* means ..... (1)
Applying and then answer 20 mins. ..... (1)
(N.B. ½ for 80 minutes)

(b) Evidence of ' $1 \cdot 5$ ' ..... (1)
Evidence of ' $1 \cdot 5^2$ ' ..... (1)
For answer $2 \cdot 25 \times 40 = 90$ mins. ..... (1) **[5 marks KU]**

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9. (a) For using $^{90}/_{360}$ (or equiv.) ..... (1)
For answer $x = 15 \cdot 7$ cm ..... (1) **[2 marks KU]**

(b) For $2\pi r = 15 \cdot 7$ ..... (1)
$r = \dfrac{15 \cdot 7}{2\pi}$ ..... (1)
$r = 2 \cdot 5$ cm ..... (1)

(c) For $s = 10$ cm (stated or implied) ..... (1)
For pyth. $10^2 = r^2 + h^2$ ..... (1)
For $h = 9 \cdot 7$ (or $9 \cdot 68$ etc.) ..... (1)
For $V = \frac{1}{3} \times \pi \times 2 \cdot 5^2 \times 9 \cdot 7$ ..... (1)
For answer $V = 63 \cdot 5$ cm^2 ..... (1) **[*8 marks RA*]**

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10. For $Fr = mv^2$ ..... (1)
$\dfrac{Fr}{m} = v^2$ ..... (1)
$\sqrt{\dfrac{Fr}{m}} = v$ ..... (1) **[3 marks KU]**

11. (a) For $\angle PQR = 150^\circ$ ..... (1)

(N.B. Pupils may still achieve full marks for part (b) even if $\angle PQR$ is wrongly stated)

(b) For use of the cosine rule ..... (1)

For correct sub. $PR^2 = 75^2 + 60^2 - (2 \times 75 \times 60 \times \cos 150^\circ)$ ..... (1)

For bracket $(7794 \cdot 2)$ ..... (1)

For $PR^2 = 17\,019 \cdot 2$ ..... (1)

For $PR = 130 \cdot 5\ km$ ..... (1)

(N.B. i) Ignore rounding errors.

ii) Use of pythagoras' $\frac{0}{5}$.

iii) Use of sin 150, instead of cos150, correctly followed through $\frac{3}{5}$ marks. **[5 marks KU]**

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12. (a) For 21 dots ..... (1)

(b) For $78 = \frac{1}{2}n^2 + \frac{1}{2}n$ ..... (1)

For $n^2 + n - 156 = 0$ ..... (1)

For $n = 12$ ..... (1)

(N.B. answer of n = 12 without working ... $\frac{1}{3}$ marks) **[*4 marks RA*]**

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13. For $\cos x^\circ = \frac{-5}{7}$ ..... (1)

$x = 135 \cdot 6^\circ$ ..... (1)

or $x = 224 \cdot 4^\circ$ ..... (1) **[3 marks KU]**

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14. (a) For $rqp = 100r + 10q + p$ ..... (1)

(b) For $pqr - rpq = 100p + 10q + r - (100r + 10q + p)$ ..... (1)

$= 99p - 99r$ (*eventually*) ..... (1)

$= 99(r + 2) - 99r$ ..... (1)

For answer $= 198$ ..... (1) **[*5 marks RA*]**

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15. For *Scale factor* $= \frac{1}{4}$ (*or* 4 *used correctly*) ..... (1)

For $S.F.^3 = \frac{1}{64}$ (*or* 64 *used correctly*) ..... (1)

For 1 litre = 1000 ml (stated or implied) ..... (1)

For answer 39 ml ..... (1)

(N.B. i) 39.06 or other approx. .... full marks

ii) $S.F.^2$ with answer $\approx$ 156 ml ..... 3 marks) **[4 marks KU]**

16. (a) For strategy i.e. knowing to sub. into $y = mx + c$ ..... (1)
For $-35 = -5m + c$ (or equiv.) ..... (1)
$7 = 2m + c$ (or equiv.) ..... (1)
Solving system ....then m = 6 ..... (1)
and c = -5 ..... (1) **[*5 marks RA*]**

(b) For answer P (0 , -5) ..... (1) **[1 mark KU]**

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17. For correct strategy (i.e. checking $f(3{\cdot}1)$, $f(3{\cdot}2)$, etc.) ..... (1)
For deducing that root lies between $3{\cdot}6$ and $3{\cdot}7$ ..... (1)
For establishing correct value of $3{\cdot}7$ ..... (1) **[3 marks KU]**

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18. (a) For $r^2 = (\sqrt{3})^2 + 1^2$ ..... (1)
For $r = 2$ ..... (1)
For $r = OB$ (stated or implied) ..... (1)
Then Area = $\frac{1}{2} \times 2 \times 1 = 1$ ..... (1)

Answers/solutions involving trig. should be checked for exactness.
Approx. solutions i.e. r = 1.966.... means 1 mark off.

(b) For $OB = r = \sqrt{x^2 + y^2}$ ..... (1)
For using y as y-coordinate at A ..... (1)
Then Area = $\frac{1}{2} \times OB \times AT$
$= \frac{1}{2} y\sqrt{x^2 + y^2}$ ..... (1) **[*7 marks RA*]**

	K U	R A
Totals	**47**	**42**