Credit Mathematics - Practice Examination E

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

1. Evaluate $38 \cdot 5 - 24 \cdot 5 \div 7$

2. (a) Evaluate $\dfrac{b}{a}$ where $a = -3$ and $b = 9$
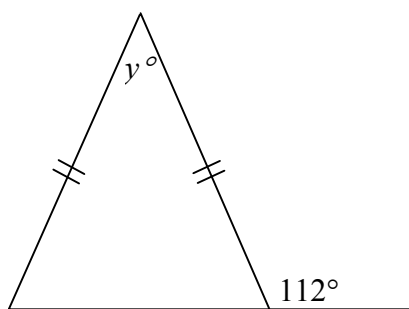
(b) Evaluate $j^2 + 4jk$ where $j = -5$ and $k = -2$

3. Evaluate $\dfrac{6}{7}$ *of* $\left(\dfrac{2}{3} - \dfrac{1}{2} \right)$

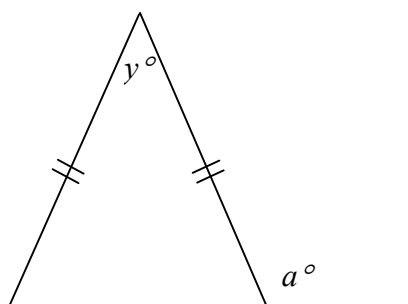**4.** (a) If $h(x) = 5x - 2x^2$, find the value of $h(-2)$

(b) Factorise **fully** $15y^2 - 3y$

(c) Hence, or otherwise, express $\dfrac{15y^2 - 3y}{25y^2 - 1}$ in its simplest form.

5. (a) Calculate the value of $y°$ in the isosceles triangle opposite.

(b) Find the value of $y°$ in terms of $a°$ in the diagram opposite.

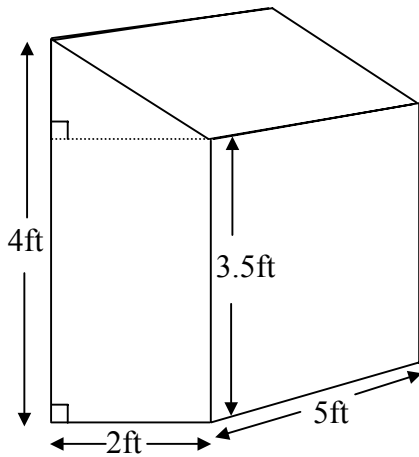**6.** (a) Remove the brackets and simplify

$$(t - 5v)(3t + 2v)$$

(b) Solve **algebraically** the equation

$$3x^2 - 13x + 4 = 0$$

(c) Solve **algebraically** the equation
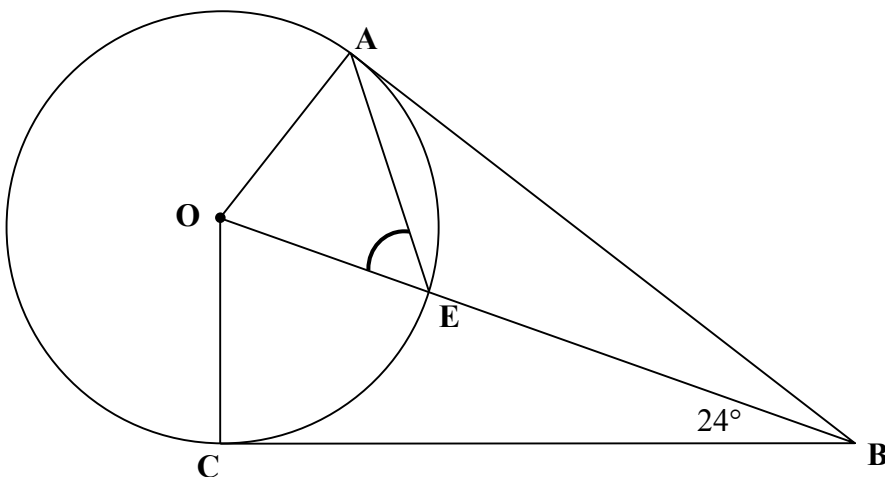
$$\frac{m}{3} - \frac{(m-3)}{2} = 1$$

7.

The diagram shows a dog's kennel.

The dimensions of the kennel, in feet, are shown.

If its two ends are congruent trapeziums and all its other faces are rectangles, find the volume of this kennel.
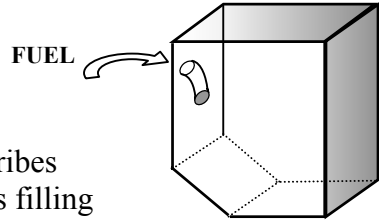
8.

The diagram above shows a quadrilateral ABCO. BA and BC are tangents to the circle, centre O, and E is the point where OB meets the circle.
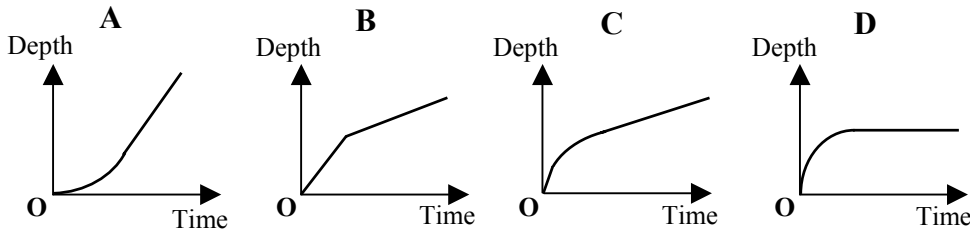
Find the size of angle OEA.

9. The diagram across shows the cross-section of the petrol tank of a Zephyr car. The tank is being filled at a constant rate.
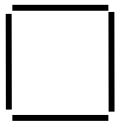
   FUEL

   Which of the following 4 graphs, A to D, best describes how the depth of the fuel is increasing as the tank is filling up with petrol?

   Give reasons for your answer.

   4

10.
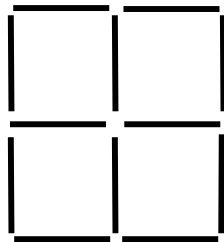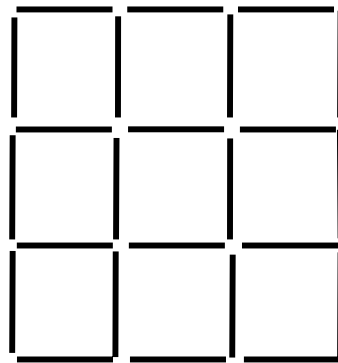
   N = 1   **N = 2**   **N = 3**

   Fred is making square patterns from headless matches.

   N stands for the number of matches along the side of each square pattern.

   (a) How many matches would be required to make the pattern where **N = 4** ?

   2

   (b) The formula for **M**, the number of matches needed to make a square of side **N** matches, is given by
   $$M = aN^2 + bN$$

   Find the values of a and b.

   4

[END OF QUESTION PAPER]

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Credit Mathematics Practice Exam E   Marking Scheme - Paper 1

	Give 1 mark for each •		Illustration(s) for awarding each mark
1.	**ans: 35**	**2 KU**	•1 24.5 /7 =… •2 35
	•1 know order of calculations •2 carry out calculations		
2.	**(a) ans: -3**	**2 KU**	(a) •1 $9 \div (-3)$ •2 -3
	•1 substitute into expression •2 evaluate		
	(b) ans: 65	**2 KU**	(b) •1 $(-5)^2 + [\ 4 \times (-5) \times (-2)\ ]$ •2 65
	•1 substitute into expression •2 multiply out		
3.	**ans:** $\dfrac{1}{7}$	**2 KU**	•1 1/6 •2 1/7 or equivalent
	•1 add fractions •2 multiply fractions		
4.	**(a) ans -18**	**2KU**	(a) •1 $5 \times (-2) - [\ 2 \times (-2) \times (-2)\ ]$ •2 -18
	•1 interpret function notation •2 evaluate function		
	(b) ans 3y(5y - 1)	**1KU**	(b) •1 $3y\ (5y - 1)$
	(c) ans $\dfrac{3y}{5y+1}$	**2KU**	(c) •1 $(5y - 1)(5y + 1)$ •2 $3y/(5y + 1)$
	•1 factorise denominator •2 simplify		
5.	**(a) ans: 44°**	**2KU**	(a) •1 $180° - 112° = 68°$ •2 $180° - 2 \times 68° = 44°$
	•1 finding the 2 equal triangle angles •2 for calculating the 3rd angle		
	(b) ans: 2a - 180°	**3RE**	(b) •1 for (180 - a)° •2 for y = 180° - 2(180 - a)° •3 for 2a - 180
	•1 for supplementary angle •2 for y = 180° - 2 x (supp. angle) •3 for answer		

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

6.	**(a) ans:** $3t^2 - 13vt - 10v^2$ **2KU**
	
	•1 for finding $3t^2$ and $-10v^2$
	•2 for finding $-13vt$
	
	(b) ans: $x = 4$ and $x = \dfrac{1}{3}$ **3KU**
	
	•1 for finding 1 factor
	•2 for finding the 2nd factor
	•3 for solving the equation
	
	(c) ans: m = 3 **3KU**
	
	•1 add the fractions
	•2 multiply expressions
	•3 solve equation
		(a) •1 $3t^2$ and $-10v^2$
		     •2 $-13vt$
		
		(b) •1 3x - 1
		    •2 x - 4
		    •3 x = 4 and x = 1/3
		
		(c) •1 multiply by 6 or take common denominator
		    •2 -m + 9
		    •3 m = 3

7.	**ans: 37.5 ft^3** **4KU** •1 for calculating rectangle area •2 for calculating triangle area •3 for calculating prism area •4 for volume	•1 2 x 3.5 =7 •2 0.5 x 2 x 0.5 =0.5 •3 7.5 •4 5 x 7.5 = 37.5
8.	**ans: 57°** **3KU** •1 for finding angle at centre •2 for finding other angle at centre as equal to •1, using tangent kite (s/i). •3 for final answer.	•1 66° •2 66° •3 57°
9.	**ans: Graph C** **4RE** •1 for non- constant initial rise on graph •2 for the nature of this rise (i.e. a curve like 'D' as opposed to 'A') •3 for constantly rising finish to the fill-up. •4 for final conclusion.	For •1 to •3, see candidates responses •4 Graph C

10.	**(a) ans 40 matches** **2RE**
	
	•1 for knowing how to continue the pattern (stated/implied/drawn)
	•2 for correct conclusion
	
	(b) ans a =2, b = 2. **4RE**
	
	•1 for using a diagram to set up 1 equation .
	•2 for using a 2nd diagram to set up another equation
	•3 for finding 1 of the variables
	•4 for finding the other variable
		(a) •1 e.g. a sketch
		
		    •2 40 matches
		
		(b) •1 e.g. a + b = 4
		    •2 e.g. 4a + 2b = 12
		
		    •3 e.g. b = 2
		    •4 e.g. a = 2

KU - 30   RE - 13   Total 43 marks

Credit Mathematics - Practice Examination E

***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

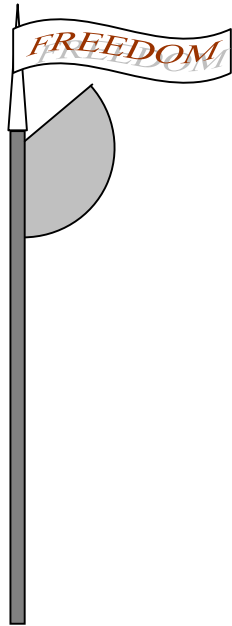The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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

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

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

Standard Deviation: $\quad$ $s = \sqrt{\dfrac{\sum(x - \bar{x})^2}{n - 1}} = \sqrt{\dfrac{\sum x^2 - \dfrac{(\sum x)^2}{n}}{n - 1}}$
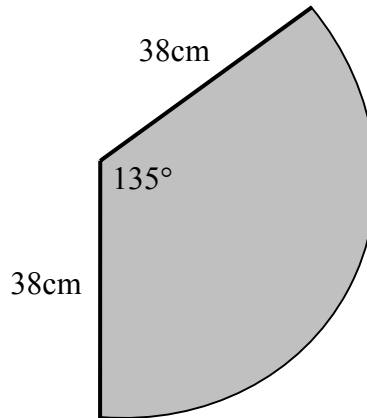
1. Wallace the Bruce, the famous Scottish hero, went into battle with a pyke which was $2 \cdot 5$ metres in length.

Its steel blade was in the shape of a sector of a circle whose edges met at an angle of 135°, as shown in the diagram below

If the edges of the blade were 38cm in length, what was the area of 1 side of the steel blade?
(Answer to the nearest cm^2)

38cm

135°

38cm

3

2. At any given temperature, the time, T minutes, taken to cook a steak varies directly with the weight, W kg, of the steak and also directly with the **square** of the distance, D cm, between the grill and the steak.

(a) Write down a formula which connects T with W and D.

1

(b) When the distance D is $2 \cdot 5$ cm, it takes 7 minutes to cook a steak.
How long would it have taken to cook the same steak, at the same temperature, if the distance had been **5** cm ?

2

3. John conducted a survey of his second year pupils to find out the most popular flavour of potato crisps. Here are his results:

Cheese and Onion	11
Smokey Bacon	8
Prawn Cocktail	6
Others	5

Draw an appropriate statistical diagram to illustrate the information that John received.

4

**4.** Solve **algebraically** the following inequality

$$5t - 8 \geq 4 - (5t - 8)$$

3

5.   (i)   Take any 3 consecutive numbers - e.g. **3, 4, 5 .**
              (ii)   Square the middle one - e.g. $4^2 = 16$
              (iii) Multiply the 2 remaining "outside" numbers e.g. **3 x 5 = 15**

      Note that the **difference** between (ii) and (iii), (i.e. **16 - 15**), is **1**.

(a) Use the same routine as above with 7, 8, 9 and show **clearly** again that the difference between (ii) and (iii) is 1.

(b) Let the first (i.e. smallest) number be *n.* Write down the next 2 numbers in terms of *n*.

(c)   Hence, or otherwise, show that the **square** of the middle number of 3 consecutive numbers will always be **1 more** than the product of the other 2 numbers.

1

2

3

6.   A toll barrier has been placed across a river to control the flow of shipping.
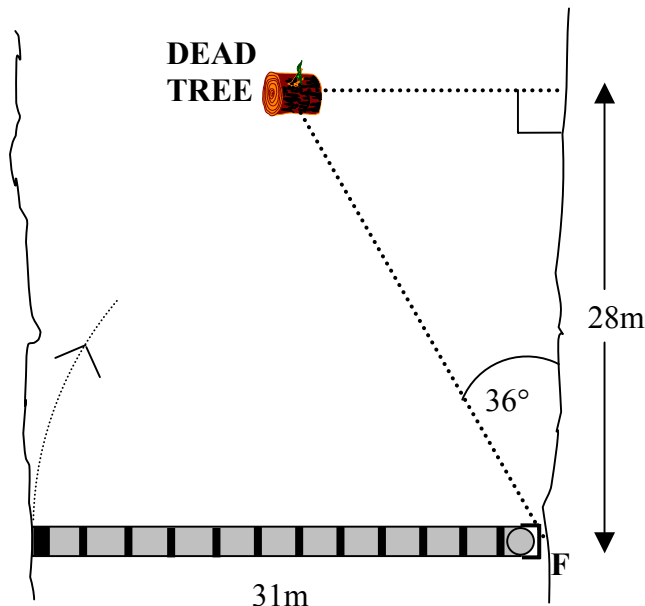
Unfortunately, a dead tree has drifted downstream and lodged itself on the river-bed at a position 28 metres directly up-river from the fulcrum, **F**, of the barrier and at an angle of 36° to the river-bank, as shown in the diagram above. **The diagram is not to scale.**

The lock-keeper in charge reckons that, if the barrier were to turn clockwise from **F**, then it would ***not*** strike the dead tree (so the tree presents no *immediate* danger to the barrier).

Is he correct? **(Show calculations to justify your answer.)**

4

7. Solve the following trigonometric equation:

$$3\sin x° + 2 = 1, \quad 0 \le x \le 360$$

3

8. A charter aeroplane, when full, can carry 96 passengers. Some of these passengers will be travelling 1st class while others will be travelling 2nd class.

Let F be the number of 1st class passengers and S be the number of 2nd class passengers.

(a) Given that the plane is full, use the information above to write down a simple equation involving F and S.

Each 1st class passenger is allowed to have 65kg of luggage but a 2nd class passenger is allowed only 35kg. The total weight of luggage allowed on board is 4140kg

(b) Assuming that each passenger has taken their maximum amount of luggage, write down another equation involving F and S.

(c) Find the number of 1st and the number of 2nd class passengers.

9.
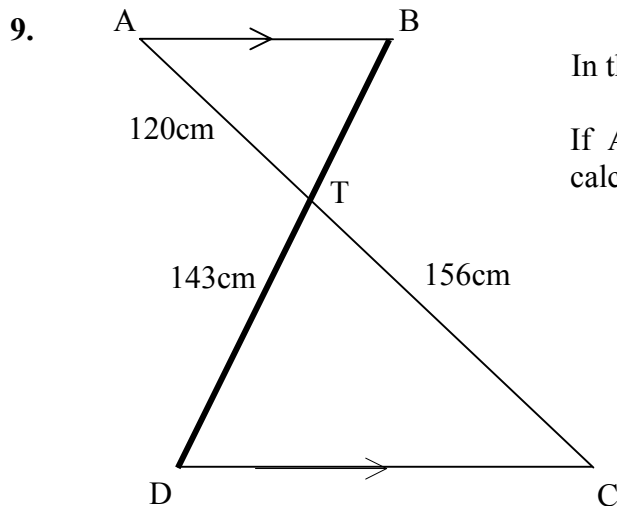
In the diagram AB is parallel to DC.

If AT=120cm, DT=143cm and CT=156cm, calculate the length of **DB**.

10. A coal mine has 2 main entrances to W, its underground workings.
The entrance at O is used for the extracted ore and as the miners entrance.
The other at S is used for supplies and machinery.
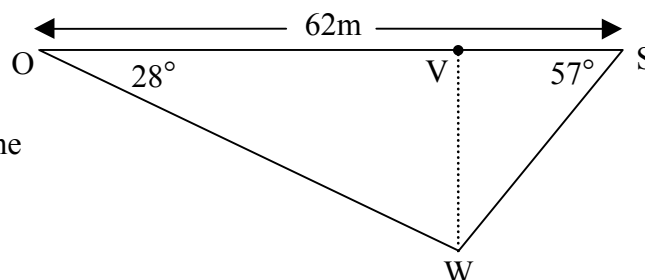
The entrances O and S are at the same horizontal level.

The distance, OS, between the two entrances is 62m.
The angle of depression of W from O is 28° and the angle of depression of W from S is 57°.
The mine owner wants to build a **vertical** shaft down to the workings from a point V, which is somewhere along the line OS.

Calculate the length of this vertical shaft, giving your answer to the nearest whole number of metres.

11. The national soft drink of Spain is called " Elaborado del Hierro" and it is sold in two main bottle sizes.
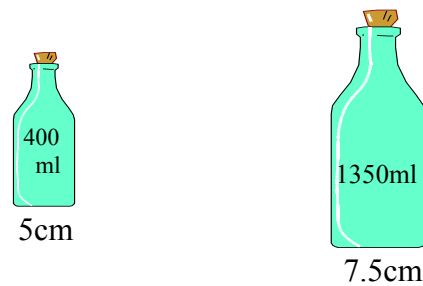
The smaller bottle has a base diameter of 5cm and holds 400ml.

The larger bottle has a base diameter of 7.5cm and it holds 1350ml.

The bottles look alike but could they actually be **mathematically** similar?
(Show calculations to justify your answer.)

12. The blood pressure of 9 young women was measured in mm.
The data gave the following summary totals:

$$\sum x = 1156 \quad \text{and} \quad \sum x^2 = 148980$$

(a) Calculate the sample mean and the standard deviation, giving your answer to 1 decimal place.

(b) A group of older women had a mean blood pressure of $158 \cdot 0$ mm and a standard deviation of $8 \cdot 6$ mm. How does the blood pressure of these older women compare with that of the younger women?

13. Solve the equation $\quad 2x^2 - x - 7 = 0.$

Give your answers **correct to 1 decimal place.**

14. A searchlight is shining its beam at a building.
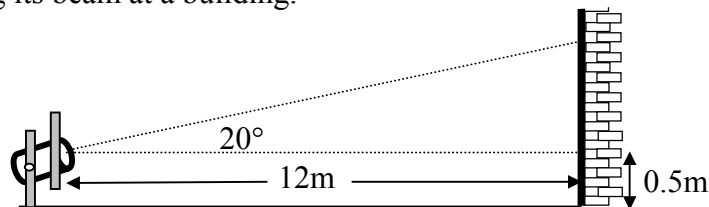
At present, the angle of elevation of the beam is 20° and the beam originates from a point $0 \cdot 5$ metres above the ground.

A security guard thinks that **doubling** the angle of elevation of the beam would **exactly double** the height that the beam presently reaches up the building.

Show that the guard is in fact **wrong**. (No marks for a scale diagram)

[END OF QUESTION PAPER]

KU column values: 4, 3, 4
RE column values: 2, 4

Credit Mathematics Practice Exam E

Marking Scheme - Paper 2

	Give 1 mark for each •	**Illustration(s) for awarding each mark**
1.	**ans: 1700 sq cm.** **3 KU** •1 for ratio •2 for formula •3 for answer	•1 135/360 •2 3.14 x 38^2 … •3 1700sq cm - do not penalise lack or errors in rounding
2.	**(a) ans : T = kWD^2** **1 KU** •1 for formula **(b) ans: 28 mins** **2 RE** •1 for idea that **doubling** D will **square** T •2 for answer	(a) •1 $T = kWD^2$ or equiv. (b) •1 e.g. $(5 / 2.5)^2$ •2 28 mins
3.	**ans: see candidates work** **4 RE** •1 proper labels •2 - •4 properly completed diagram.	•1 •2 - •4 e.g. correct rectangles on barchart
4.	**ans : t $\geq$ 2** **3 KU** •1 for terms collected •2 for numbers collected •3 for answer	•1 10t or - 10t •2 20 or - 20 •3 t $\geq$ 2
5.	**(a) ans: difference is 1** **1 RE** •1 for clear use of the algorithm **(b) ans: n + 1 and n + 2** **2 RE** •1 for 1st term •2 for 2nd term **(c) ans: proof** **3 RE** •1 for applying 1st part of algorithm. •2 for applying 2nd part. •3 for final proof	(a) •1 8x8=64, 9x7=63 and 64 - 63=1 (b) •1 n + 1 •2 n + 2 (or n + 1 + 1) (c) •1 $(n +1)^2 = n^2 + 2n + 1$ •2 $n (n + 2) = n^2 + 2n$ •3 difference is 1 clearly shown.
6.	**ans: lock-keeper correct since 34.6 > 31** **4 RE** •1 for use of trigonometry •2 for use of trigonometry where x is the distance from dead tree to F. •3 for x = 34.6 or 35 •4 for correct conclusion.	•1 cos 36°=… •2 …=28/x •3 x = 34.6 or 35 •4 lock-keeper is correct (34.6 > 31, so barrier will miss the tree.)

	Give 1 mark for each •	**Illustration(s) for awarding each mark**
7.	**ans: 199.5°, 340.5°** **3 KU** •1 for manipulation to sinx =… •2 for calculation •3 for 2nd answer	•1 sinx = - 1/3 •2 x = (- 19.5° =) 340.5° •3 x = 199.5° N.B. x = - 19.5° is not acceptable for •2

8.	**(a) ans: F+ S = 96** **1 RE**
	
	•1 for equation
	
	(b) ans: 65F + 35S = 4140 **2 RE**
	
	•1 for part of equation
	•2 for part of equation
	
	(c) ans: F = 26, S = 70 **3 RE**
	
	•1 for setting up the sim. equations
	•2 for calculating 1 variable
	•3 for calculating the other variable
		(a) •1 F + S = 96
		
		(b) •1 e.g. 65F + 35S…
		   •2 65F + 35 = 4140
		
		(c) •1 65F + 35 = 4140, F + S = 96
		   •2 F = 26
		   •3 S = 70

9.	**ans: DB = 253cm** **3 KU** •1 and •2 for scale factor or fractions •3 for final answer.	•1 - •2 S.F. = 120/156 or equiv. or BT/143 = 120/156 •3 BT = 110cm **and** DB = 253cm.
10.	**ans: VW = 25m** **5 RE** •1 for attempting to find OW or WS using the sine rule •2 for OW = … •3 for finding OW. •4 for using trig. to find VW. •5 for finding VW.	•1 e.g. OW / sin57° = 62 / sin95° •2 OW = sin57° x 62 / sin95° •3 OW = 52.2 •4 e.g. sin 28° = VW / 52 •5 VW = 25m. N.B. Ignore premature rounding - this will usually lead to a rounded answer of **24**m. Also, do **not** penalise **unrounded** answers. *Note: There are other ways to this solution, mark at your own discretion.*

	Give 1 mark for each •	Illustration(s) for awarding each mark
11.	**ans : Yes, bottles could be similar 4 KU** • 1 calculating the linear scale factor • 2 knowing to **cube** the S.F. • 3 for calculating the new volume • 4 for consistent conclusion	• 1 $7.5 / 5 = $ S.F. • 2 $1.5^3 = 3.375$ s/i • 3 V = 400 x 3.375 =1350 • 4 bottles **could** be similar since volumes are consistent with similar shape
12.	**(a) ans: 128.4 and 7.9 3 KU** • 1 calculate mean to 1 d.p. • 2 substitute into formula for standard form • 3 calculate the standard deviation. **(b) ans: older women have higher blood pressure and s.d. is higher** **2 RE** • 1 compare blood pressure • 2 compare standard deviation.	(a) • 1 128.4 • 2 $\sqrt{\dfrac{148980 - \dfrac{1156^2}{9}}{9-1}}$ • 3 7.9 (b) • 1 e.g. these women have higher blood pressure • 2 e.g. the standard deviation is "higher" for these older women(accept "about the same as ")
13.	**ans: - 2.6 or 2.1 4 KU** • 1 identify constants • 2 substitute constants into quadratic formula • 3 calculation of 1 value • 4 calculation of the other value	• 1 a=2, b=-1,c=-7 • 2 $x = \dfrac{-(-1) \pm \sqrt{(-1)^2 - 4x2x(-7)}}{4}$ • 3 $x = -1.6$ • 4 $x = 2.1$
14.	**ans: proof** $(4.87 \times 2 \neq 10.57)$ **4 RE** • 1 use correct trig. function to calculate height • 2 calculation , adding the 0.5m • 3 knowing to double the angle and to re-calculate the "new"height • 4 compare the 2 heights and clearly show that 1 is not exactly the double of the other.	• 1 tan20 = x / 12 • 2 $x_1 = 4.37 + 0.5 = 4.87$m • 3 $x_2 =10.07 + 0.5 = 10.57$ • 4 $4.87 \times 2 \neq 10.57$

KU - 24   RE - 33   Total 57 marks