N5

Practice Paper C

MATHEMATICS
National Qualifications - National 5
Paper 1 (non-calculator)
Covering all Units

Time allowed - 1 hour

Fill in these boxes and read carefully what is printed below

Full name of centre | **Town**

Forename(s) | **Surname**

Date of birth
Day Month Year

Candidate number

Seat number

Total marks - 40

1. You may NOT use a calculator.
2. Use **blue** or **black** ink. Pencil may be used for graphs and diagrams only.
3. Write your working and answers in the spaces provided. Additional space for answers is provided at the end of the booklet. If you use this space, write clearly the number of the question you are attempting.
4. Square ruled paper is provided.
5. Full credit will be given only where the solution contains appropriate working.
6. State the units for your answer where appropriate.
7. Before leaving the examination room you must give up this booklet to the invigilator. If you do not, you may lose all the marks for this paper.

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 = $\frac{1}{2} ab \sin C$

Volume of a sphere: Volume = $\dfrac{4}{3}\pi r^3$

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

Volume of a Pyramid: Volume = $\dfrac{1}{3}Ah$

Standard deviation: $s = \sqrt{\dfrac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\dfrac{\sum x^2 - (\sum x)^2 / n}{n-1}}$, where n is the sample size.

Do not write in this margin.

All questions should be attempted *Marks*

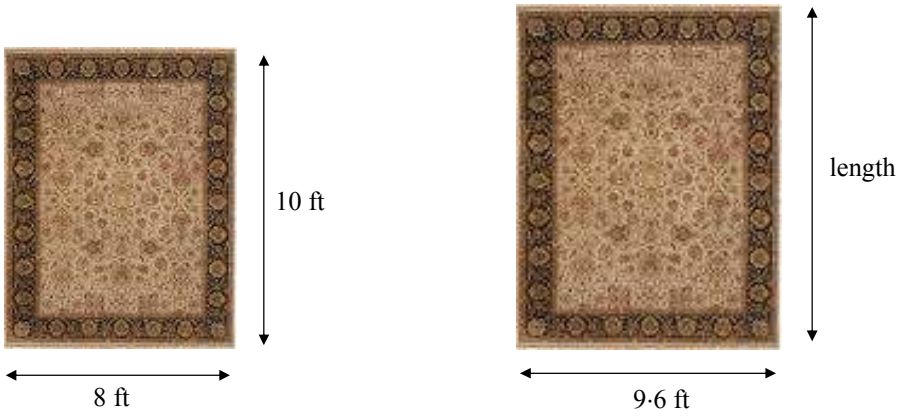
1. Lauren and Vicky record the amount of time they spend in the gym every day.

The Standard Deviation of the time Lauren spends is 4·4 and for Vicki is 5·7.

Compare the two sets of data making particular reference to the spread of the times the 2 girls spend in the gym. **1**

2. James is looking to buy a new rug.

The two rugs below are **mathematically similar** in shape.



He is hoping that the length of the large rug will be enough to make the **area** of the large rug **at least 120 square feet**.

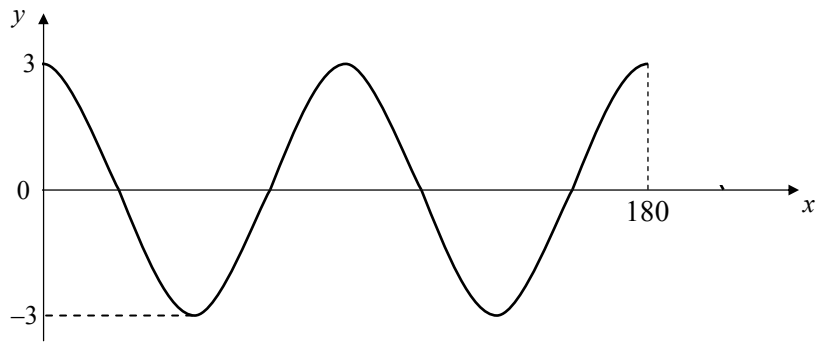
Does the large rug have the required area?

You must show appropriate working and give a reason for your answer. **4**

3. Evaluate $1\frac{1}{3} + \frac{3}{5}$ of $2\frac{1}{7}$ **3**

Marks

4. The diagram below shows the graph of $y = a\cos bx^\circ$ for $0 \le x \le 360$.



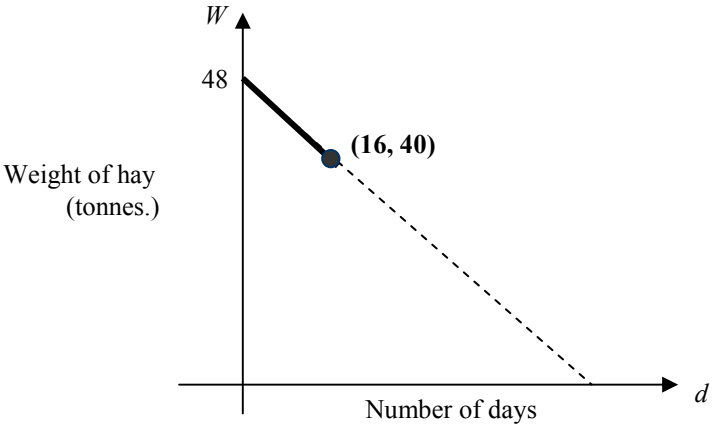
Write down the values of a and b. **2**

5. **(a)** Simplify $\dfrac{a^2 \times a^5}{a^{-3}}$ **2**

(b) Evaluate $125^{\frac{2}{3}}$ **2**

Do not write in this margin.

6. The local riding stables buy in 48 tonnes of hay to feed the horses during the winter season, which lasts for 93 days.
After 16 days they have 40 tonnes of hay left.
The graph below illustrates the situation.



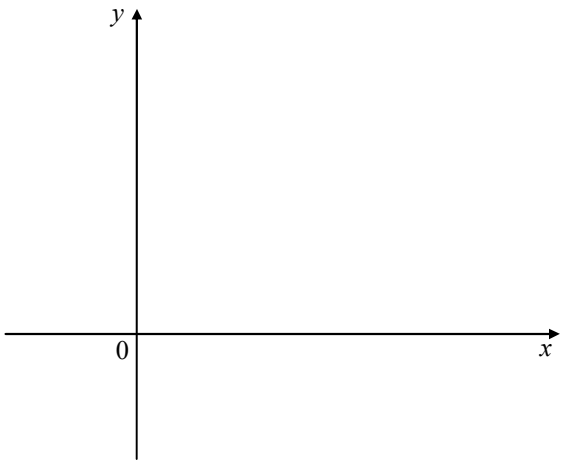
(a) Find the equation of the line shown above. **3**

(b) If the horses continue to consume the hay at this rate, will it last to the end of the winter season? **3**

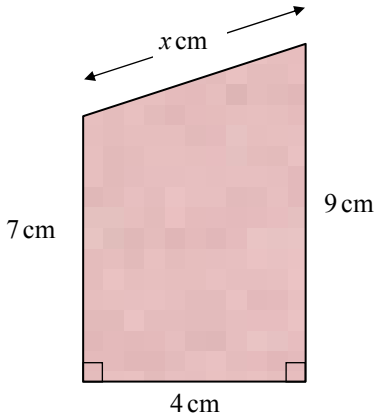
Marks

7. A graph has equation of the form $y = \boldsymbol{a}x^2 + \boldsymbol{b}x + c$.

Given that $\boldsymbol{a} > 0$ and $\boldsymbol{b}^2 - 4\boldsymbol{ac} < 0$, draw a possible graph for y. **3**



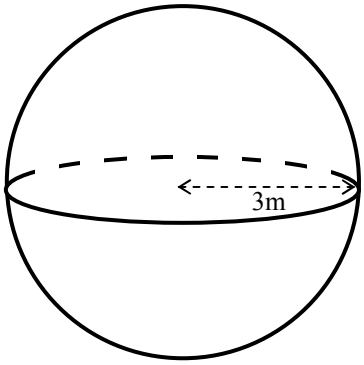
8. The diagram below shows the end view of a scale model of a garden shed.



Calculate the exact value of x, giving your answer as a surd in its simplest form. **4**

Marks

9. Calculate the volume of this sphere which has radius 3m. **3**
[Take $\pi = 3 \cdot 14$]



10. A quadratic graph has equation $y = 5 - (x + 2)^2$.

(a) What are the coordinates **and** nature of the turning point of the graph? **3**

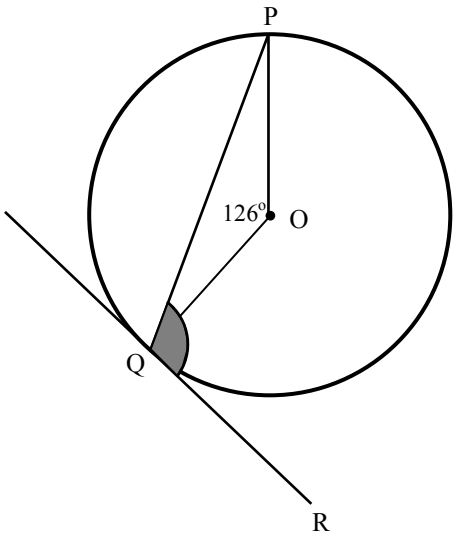
(b) Which of the following is the equation of its axis of symmetry? **1**

A $x = -2$
B $x = 2$
C $x = 5$
D $x = -5$

Marks

11. P and Q are points on the circumference of this circle with centre O.
PR is a tangent to the circle and angle AOB = 126^o.

Calculate the size of angle PQR, the shaded area in the diagram. **2**



12. Solve the equation

$$x(x-3) = 10$$ **4**

End of Question Paper

Qu	Give one mark for each •	Illustrations for awarding mark
1	**ans : comment** **1 mark** •[1] compares Standard Deviations	 •[1] Vicki's times are less consistent than Lauren's [or equivalent].
2	**ans : will not be big enough** **4 marks** •[1] finds linear scale factor •[2] finds length of missing side •[3] finds area of large rug •[4] valid conclusion Area scale factor can also be used •[1] finds linear scale factor •[2] finds area scale factor •[3] finds area of large rug •[4] valid conclusion	 •[1] L.S.F. = 9·6/8 = 1·2 [or equivalent] •[2] 1·2 × 10 = 12 •[3] 9·6 × 12 •[4] realises area < 120 square feet •[1] L.S.F. = 9·6/8 = 1·2 [or equivalent] •[2] A.S.F. = $(1{\cdot}2)^2 = 1{\cdot}44$ •[3] 1·44 × 80 •[4] realises area < 120 square feet
3	**ans:** $\frac{55}{21} = 2\frac{13}{21}$ **3 marks** •[1] know order of calculations •[2] multiply fractions correctly •[3] add fractions correctly	 •[1] $\frac{3}{5} \times \frac{15}{7}$ •[2] $1\frac{1}{3} + \frac{9}{7}$ •[3] $2\frac{13}{21}$
4	**ans:** $a = 3$; $b = 4$ **2 marks** •[1] states value of a •[2] states value of b	 •[1] $a = 3$ •[2] $b = 4$
5(a)	**ans :** a^{10} **2 marks** •[1] simplifies numerator •[2] simplifies expression	 •[1] a^7 •[2] a^{10}
5(b)	**ans: 25** **2 marks** •[1] interprets index •[2] evaluates	 •[1] $125^{\frac{2}{3}} = \sqrt[3]{125^2}$ •[2] 25
6(a)	**ans:** $W = -0{\cdot}5d + 48$ **3 marks** •[1] identifies y - intercept •[2] calculates gradient •[3] states equation	 •[1] $c = 48$ •[2] $m = \frac{48-40}{0-16} = -0{\cdot}5$ •[3] $W = -0{\cdot}5d + 48$
6(b)	**ans: Yes, 3 days spare** **3 marks** •[1] correct strategy •[2] solves equation •[3] correct conclusion	 •[1] $-0{\cdot}5\,d + 48 = 0$ •[2] $d = 96$ •[3] yes, 3 days to spare

Qu	Give one mark for each •	Illustrations for awarding mark
7	**ans : suitable graph drawn 3 marks** •^{1} correct shape •^{2} correct nature of turning point •^{3} no roots	 •^{1} parabolic shape [accept any] •^{2} minimum turning point •^{3} graph above x – axis
8	**ans : $2\sqrt{5}$ 4 marks** •^{1} assembles facts in R A T •^{2} knows to use Pythagoras •^{3} finds length as surd •^{4} simplifies	 •^{1} •^{2} $x = \sqrt{(4^2 + 2^2)}$ •^{3} $x = \sqrt{20}$ •^{4} $x = 2\sqrt{5}$
9	**ans : 113·04cm^3 3 marks** •^{1} subs values in correct formula •^{2} starts to evaluate •^{3} answer	 •^{1} $V = \frac{4}{3} \times 3 \cdot 14 \times 3^3$ •^{2} evidence of carrying out part calculation •^{3} 113·04cm^3
10	**ans: (–2, 5); maximum 3 marks** •^{1} states x – coordinate of T.P. •^{2} states y – coordinate of T.P. •^{3} identifies nature **ans: A 1 mark** •^{1} correct axis of symmetry	 •^{1} (–2, ……. •^{2} ……, 5) •^{3} maximum •^{1} A
11	**ans : 117^o 2 marks** •^{1} recognises isosceles triangle •^{2} recognises right angle	 •^{1} $\angle$ ABO = 27^o •^{2} $\angle$ABC = 90 + 27 = 117^o
12	**ans : $x = 5$ or $x = -2$ 4 marks** •^{1} multiplies brackets/collects terms to LHS •^{2} factorises •^{3} equate each bracket to zero •^{4} solves for x	 •^{1} $x^2 - 3x = 10$; $x^2 - 3x - 10 = 0$ •^{2} $(x - 5)(x + 2) = 0$ •^{3} $(x - 5) = 0$; $(x + 2) = 0$ •^{4} $x = 5$ or $x = -2$
		Total 40 marks

N5

Practice Paper C

MATHEMATICS

National Qualifications - National 5

Paper 2 (Calculator)

Covering all Units

Time allowed - 1 hour and 30 minutes

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Full name of centre | **Town**

Forename(s) | **Surname**

Date of birth Day Month Year | **Candidate number** | **Seat number**

Total marks - 50

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Volume of a Pyramid: Volume = $\dfrac{1}{3}Ah$

Standard deviation: $s = \sqrt{\dfrac{\sum(x - \bar{x})^2}{n-1}} = \sqrt{\dfrac{\sum x^2 - (\sum x)^2 / n}{n-1}}$, where n is the sample size.

Do not write in this margin.

Marks

All questions should be attempted

1. A patient in a hospital is injected with 200 mg of a drug.

(a) It is known that for each hour after the injection the number of milligrams of the drug left in the body is 15% less than at the beginning of that hour.

How many milligrams of the drug are left in the patient's body at the end of 3 hours? **3**

(b) The patient is given a second drug.

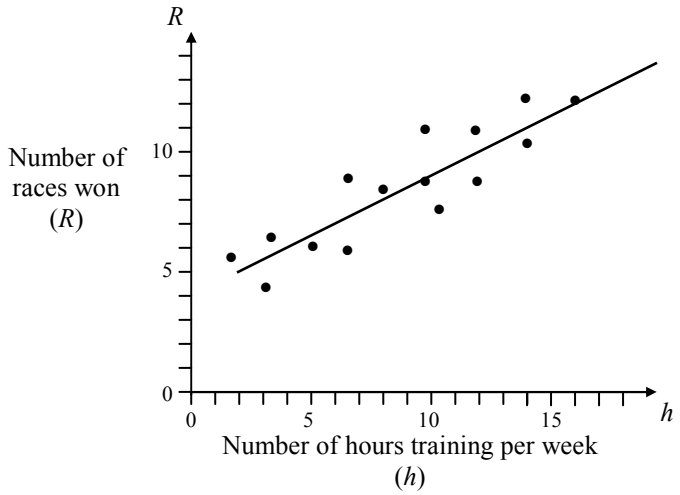
It is known that, for this second drug, at the end of each hour the number of milligrams of the drug left in the body is 12% less than at the beginning of that hour.

At the end of one hour the patient had $123 \cdot 2$ mg of the second drug left in his body.

Calculate the size of the initial dose, of this second drug, given to the patient. **2**

2. Vector $\boldsymbol{a}$ has components $\boldsymbol{u} = \begin{pmatrix} -4 \\ 2 \\ k \end{pmatrix}$. If $|\boldsymbol{u}| = 6$, calculate the values of k. **4**

3. The graph below shows the relationship between the number of hours (h) a swimmer trains per week and the number of races (R) they have won.



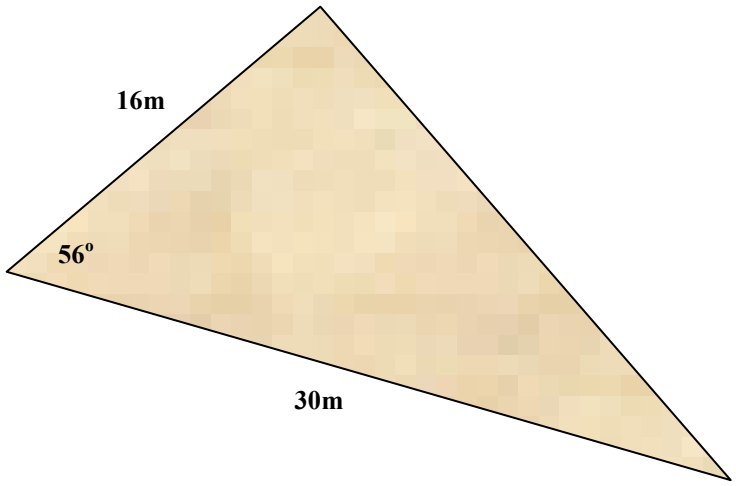
A best fitting straight line has been drawn.

(a) Use information from the graph to find the equation of this line of best fit. **3**

(b) Use the equation to predict how many races a swimmer who trains 22 hours per week should win. **1**

Marks

4. A building company has to fence off a triangular piece of waste ground. The plan of the ground is shown below. All lengths are in metres.



If the fence costs £18.50 per metre to erect, how much will the company have to pay in total to fence off this piece of ground?

Give your answer to the nearest ten pounds. **5**

5. Determine the nature of the roots of the quadratic equation

$$2x^2 - 3x + 7 = 0$$ **3**

Marks

6. Some friends stopped at a roadside café.

(a) Peter bought 3 bacon rolls and 2 cups of tea which cost him a total of £5.10. Taking the cost of a bacon roll as 'x' pence and 'y' as the cost of a cup of tea, write an equation to illustrate this. **1**

At the same café, Colin bought 2 bacon rolls and 1 cup of tea and was charged £3.15.

(b) Construct a second equation to illustrate this. **1**

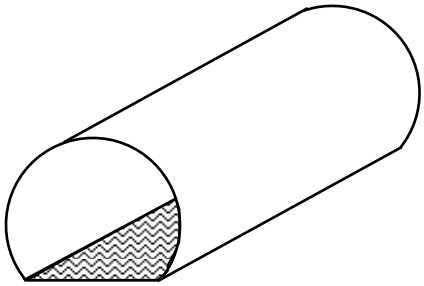
(c) How much did Stewart pay for 4 bacon rolls and 3 cups of tea? **4**

7. Simplify this fraction $\dfrac{10x^2 - 17x + 3}{4x^2 - 9}$ **3**

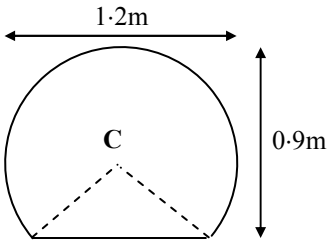
Do not write in this margin.

Marks

8. Shown is a children's play tunnel which has been fitted with a rectangular insulating mat .



The end of the tunnel consists of part of a circle, centre **C**, with diameter 1·2 metres.

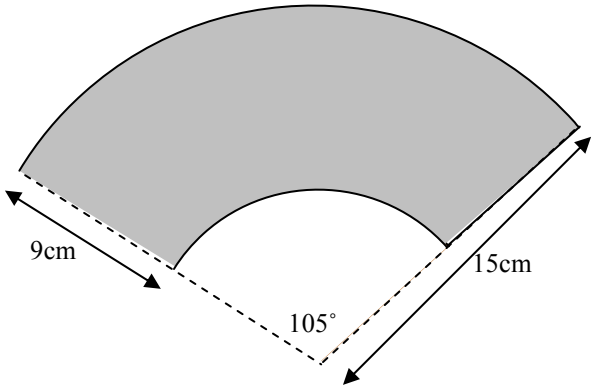


The height of the tunnel is 0·9 metres.

Calculate the area of the mat if the tunnel is 7 metres long. **4**

Marks

9. A hand fan is made of wooden slats with material on the outer edge.



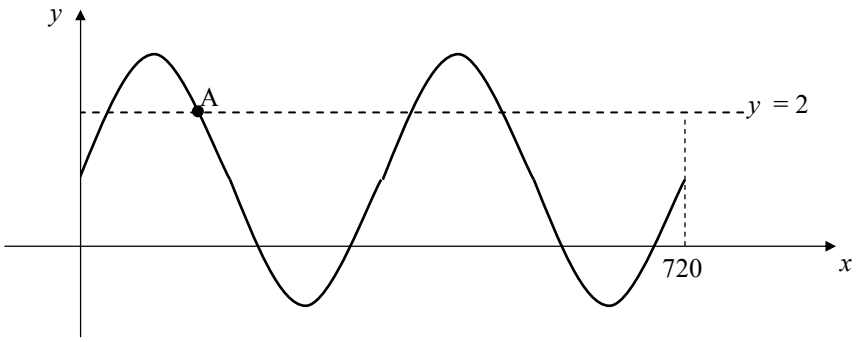
Calculate the area of material needed for the hand fan. **5**

10. Simplify $\dfrac{1-\cos^2 x}{\cos^2 x}$ **2**

Marks

11. The diagram below shows the graph of $y = 2\sin x^\circ + 1$ for $0 \le x \le 720$.

The line $y = 2$ has also been drawn on the diagram.

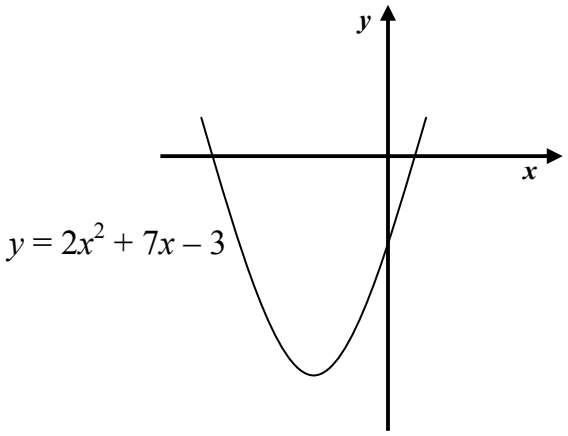


Find the coordinates of point A. **4**

Do not write in this margin.

Marks

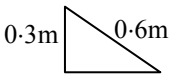
12. The diagram show the graph of $y = 2x^2 + 7x - 3$



Find the x - coordinates of the points where the graph crosses the x - axis giving your answers correct to 1 decimal place. **5**

End of Question Paper

Qu	Give one mark for each •	Illustrations for awarding mark
1a	**ans : 122·825 mg** **3 marks**	
	•[1] correct multiplier	•[1] …… × 0·85
	•[2] knows how to decrease for 3 hours	•[2] $200 \times 0{\cdot}85^3$
	•[3] answer	•[3] 122·825 mg
b	**ans: 140 mg** **2 marks**	
	•[1] method	•[1] 88% = 123·2 ÷ 0·88
	•[2] answer	•[2] 140 mg
2	**ans : 4 or – 4** **4 marks**	
	•[1] knows how to find magnitude	•[1] $\sqrt{(-4)^2+(2)^2+k^2}$
	•[2] equates to 6^2	•[2] $\sqrt{(-4)^2+(2)^2+k^2}=6^2$
	•[3] removes roots signs and simplifies	•[3] $20+k^2=36; k^2=16$
	•[4] solves	•[4] $k=\pm 4$
3a	**ans : $R = \frac{1}{2}h + 4$** **3 marks**	
	•[1] finds gradient of line	•[1] $m = \frac{1}{2}$
	•[2] finds y – intercept	•[2] (0, 4)
	•[3] states equation of line	•[3] $R = \frac{1}{2}h + 4$
b	**ans: 15 races won** **1 mark**	
	•[1] subs into equation and evaluates	•[1] ½(22) + 4 = 15
4	**ans: £1 310** **5 marks**	
	•[1] knows to use Cosine rule	•[1] evidence
	•[2] subs values into formula	•[2] $x^2 = 16^2 + 30^2 - 2 \times 16 \times 30 \times \cos 56°$
	•[3] evaluates	•[3] 24·9 m
	•[4] finds perimeter	•[4] 30 + 16 + 24·9 = 70·9 m
	•[5] calculates cost of fencing to nearest £	•[5] 70·9 × £18.50 = £1 310 to nearest £10
5	**ans : no real roots** **3 marks**	
	•[1] knows to find discriminant	•[1] evidence of finding $b^2 - 4ac$
	•[2] finds discriminant	•[2] $(3)^2 - 4 \times 2 \times 7 = -47$
	•[3] valid conclusion	•[3] no real roots
6a	**ans: $3x + 2y = 5{\cdot}10$** **1 mark**	
	•[1] states equation	•[1] $3x + 2y = 5{\cdot}10$
b	**ans: $2x + y = 3{\cdot}15$** **1 mark**	
	•[1] states equation	•[1] $2x + y = 3{\cdot}15$

Qu	Give one mark for each ●	Illustrations for awarding mark
c	**ans: £7.05 4 marks** ●1 knows to use sim. equations ●2 prepares equations ●3 finds value for x and y ●4 calculates cost	 ●1 evidence ●2 equates x or y coefficients ●3 $x = 1{\cdot}20$; $y = 0{\cdot}75$ ●4 £1.20 × 4 + 0·75 × 3 = £7.05
7	**ans : $(5x - 1)/(2x + 3)$ 3 marks** ●1 factorises numerator ●2 factorises denominator ●3 simplifies	 ●1 $(5x - 1)(2x - 3)$ ●2 $(2x - 3)(2x + 3)$ ●3 $(5x - 1)/(2x + 3)$
8	**ans : $7m^2$ 4 marks** ●1 interpret information in rt. Triangle ●2 calculate missing side ●3 state breadth of mat ●4 calculate area	 ●1  ●2 $\sqrt{(0{\cdot}6^2 - 0{\cdot}3^2)} = 0{\cdot}5\,\text{m}$ ●3 breadth = 1m ●4 7m²
9	**ans : 173·18 cm^2 5 marks** ●1 knows how to calculate area of sector ●2 calculates area of large sector ●3 calculates radius of smaller sector ●4 calculates area of small sector ●5 subtracts areas	 ●1 $^{105}/_{360} \times \pi \times \ldots^2$ ●2 $^{105}/_{360} \times \pi \times 15^2 = 206{\cdot}17\ \text{cm}^2$ ●3 15 – 9 = 6cm ●4 $^{105}/_{360} \times \pi \times 6^2 = 32{\cdot}99\ \text{cm}^2$ ●5 $206{\cdot}17 - 32{\cdot}99 = 173{\cdot}18\ \text{cm}^2$
10	**ans : $\tan^2 x^o$ 2 marks** ●1 replaces $1 - \cos^2 x°$ ●2 simplifies	 ●1 $\sin^2 x°$ ●2 $\tan^2 x°$
11	**ans: A(150°, 2) 4 marks** ●1 equates equation to 2 ●2 solves for $\sin x^o$ ●3 finds solution(s) ●4 states coordinates of A	 ●1 $2 = 2\sin x^\circ + 1$ ●2 $\sin x^\circ = \frac{1}{2}$ ●3 $x = 30^o$ or 150^o ●4 A(150°, 2)
12	**ans : 0·4; –3·9 5 marks** ●1 equates equation to zero ●2 knows to use quadratic formula ●3 evaluates discriminant ●4 finds roots [no rounding] ●5 rounds correctly	 ●1 $2x^2 + 7x - 3 = 0$ ●2 evidence of substituting values ●3 √73 ●4 $(-7 + \sqrt{73}) \div 4$; $(-7 - \sqrt{73}) \div 4$ ●5 0·4; –3·9
		Total 50 marks