N4 RELATIONSHIPS 1.2

This resource is to support pupils in passing the appropriate National 4 Assessment Standard. The questions and marking schemes used are from SQA past papers and as such test the topics in their entirety from grade A to C and *may* include other areas from the course. In addition the questions from **Paper 1** (P1) should be completed **without** the use of a calculator and questions from **Paper 2** (P2) permit the use of a calculator.

Each Assessment Standard is used to ensure pupils have the minimum competency on the specified sub-skills for the National 4 course. As such each Assessment Standard will test grade C work on that specific topic.

This resource is divided into two sections:

- Section A has an example on each sub skill for the relevant Assessment Standard and the marking scheme for these questions
- Section B has extra practice questions on this Assessment Standard and the marking scheme for these questions

Unit Assessment Standard	Sub skills	Section A – Question Number
Relationships 1.2 Applying geometric skills to sides and angles of shapes	The sub-skills are: using Pythagoras' theorem	Q1 (Finding the Hypotenuse) Q2 (Finding a shorter side)
	using a fractional scale factor to enlarge or reduce a shape	Q3 (Enlarge) Q4 (Reduce)
	using parallel lines	Q5
	symmetry and circle properties to calculate angles	Q6

FORMULAE LIST

Circumference of a circle: $C = \pi d$

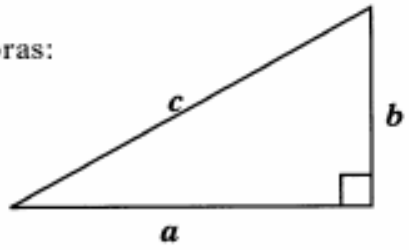
Area of a circle: $A = \pi r^2$

Curved surface area of a cylinder: $A = 2\pi rh$

Volume of a cylinder: $V = \pi r^2 h$

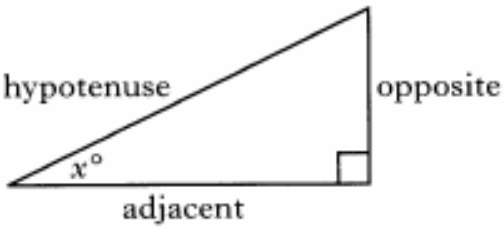
Volume of a triangular prism: $V = Ah$

Theorem of Pythagoras:



$$a^2 + b^2 = c^2$$

Trigonometric ratios in a right angled triangle:

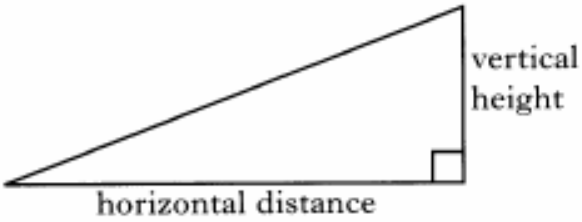


$$\tan x^\circ = \frac{\text{opposite}}{\text{adjacent}}$$

$$\sin x^\circ = \frac{\text{opposite}}{\text{hypotenuse}}$$

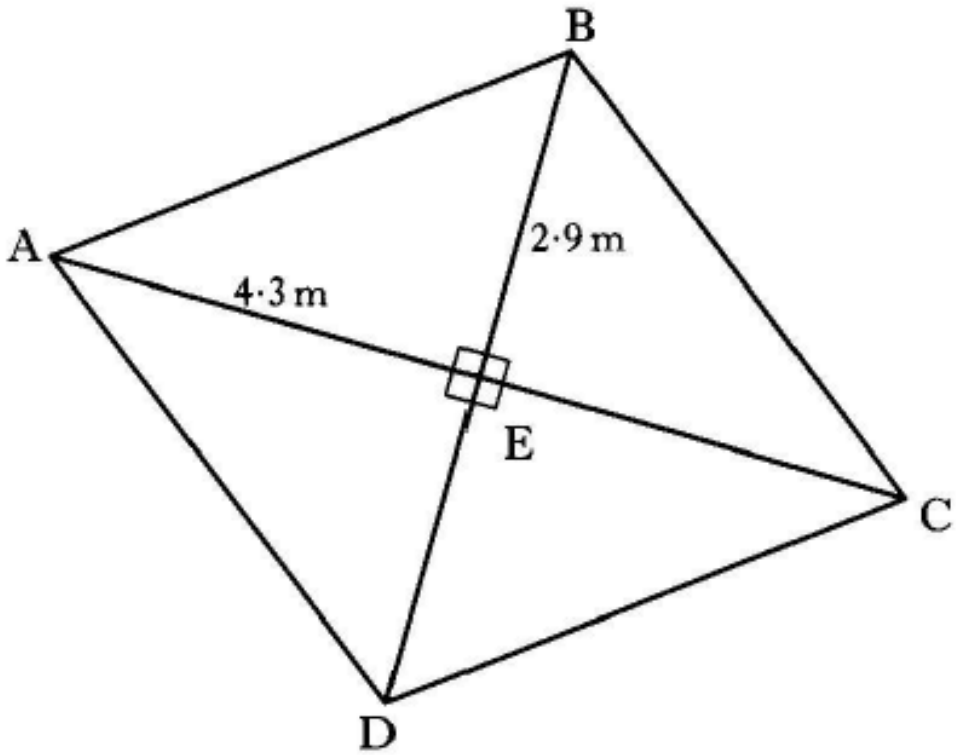
$$\cos x^\circ = \frac{\text{adjacent}}{\text{hypotenuse}}$$

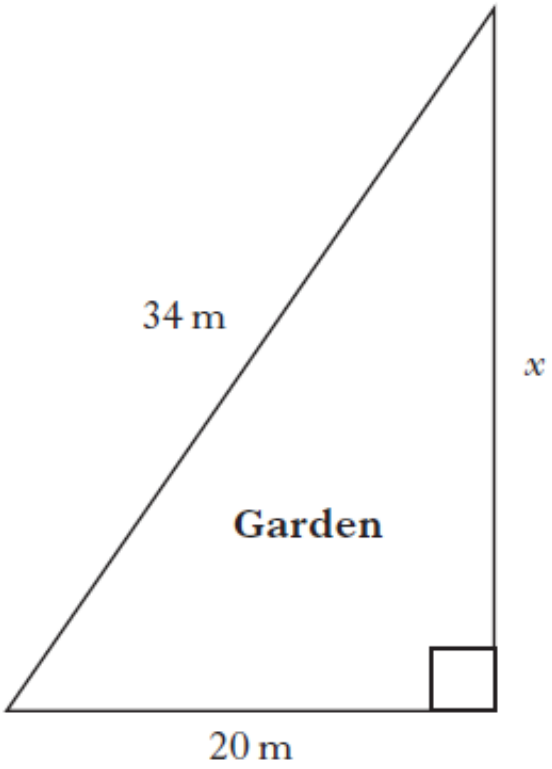
Gradient:



$$\text{Gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$

Section A

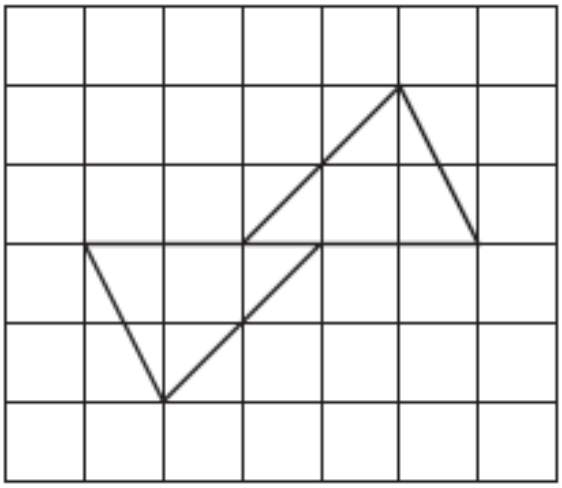
		Marks
Q1 P2	**8.** ABCD is a rhombus. AE = 4·3 metres and BE = 2·9 metres. Calculate the perimeter of the rhombus.  **Do not use a scale drawing.**	**4**

Q2 P2	**5.**  Alison's garden is in the shape of a right angled triangle. She measured two sides of the garden. Calculate the length, x, of the third side of her garden. Round your answer to one decimal place. **Do not use a scale drawing.**	**4**

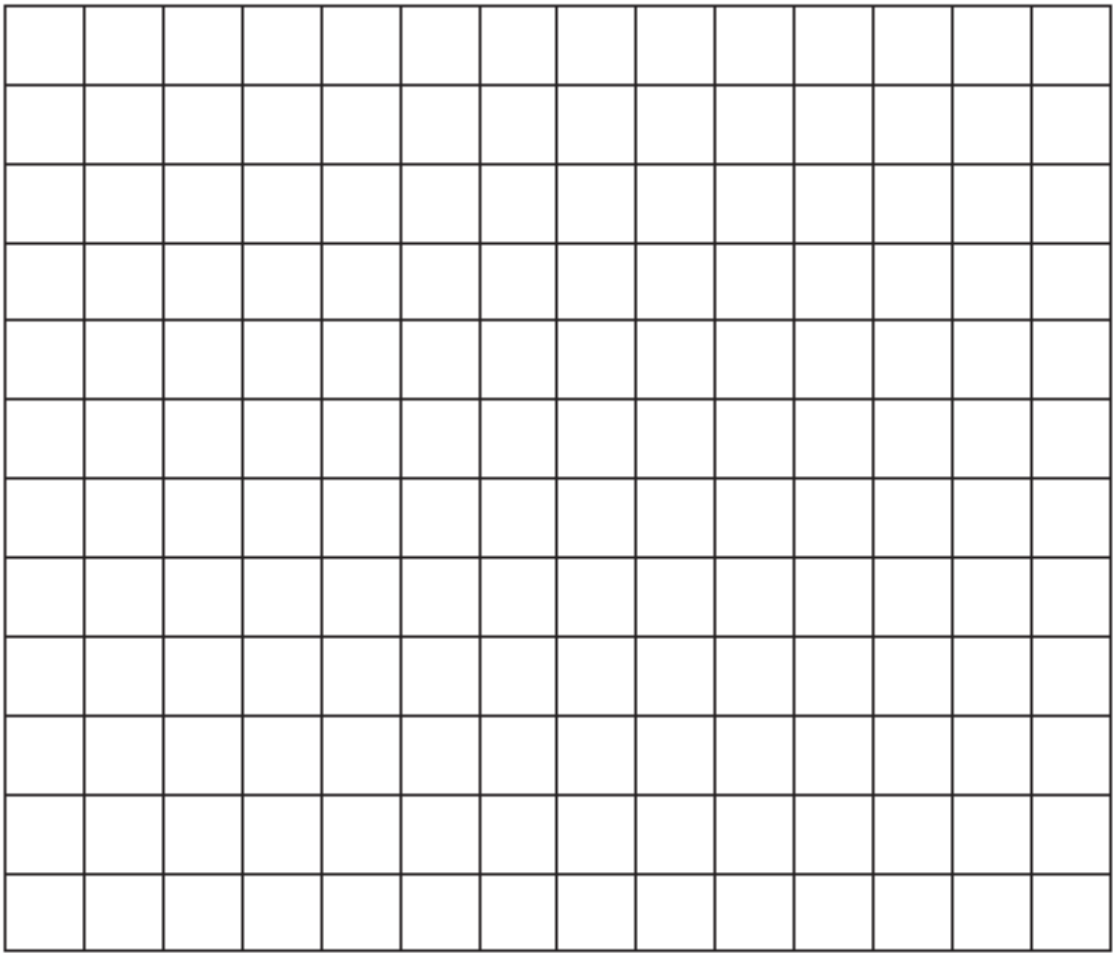
Q3 P2

2. John has drawn this design.

3



Using a scale factor of 2, draw an enlargement of John's design on the grid below.

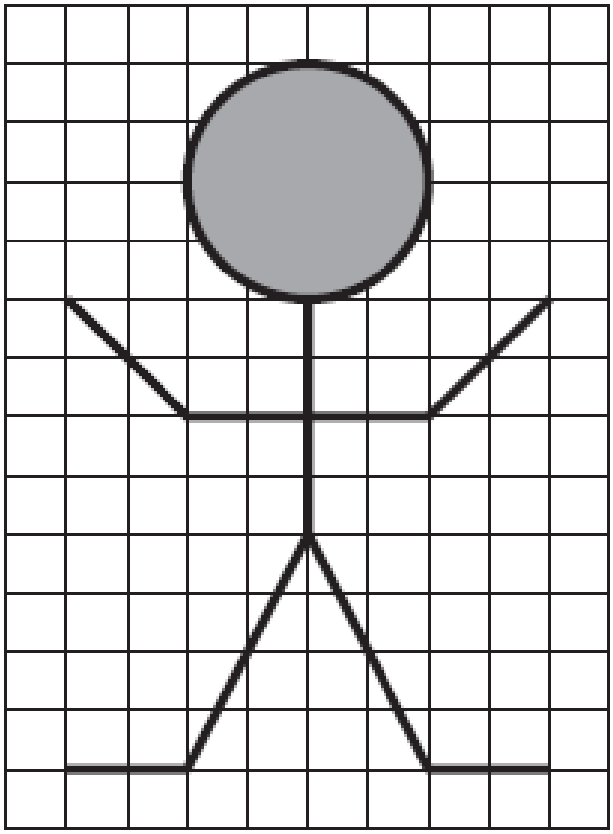


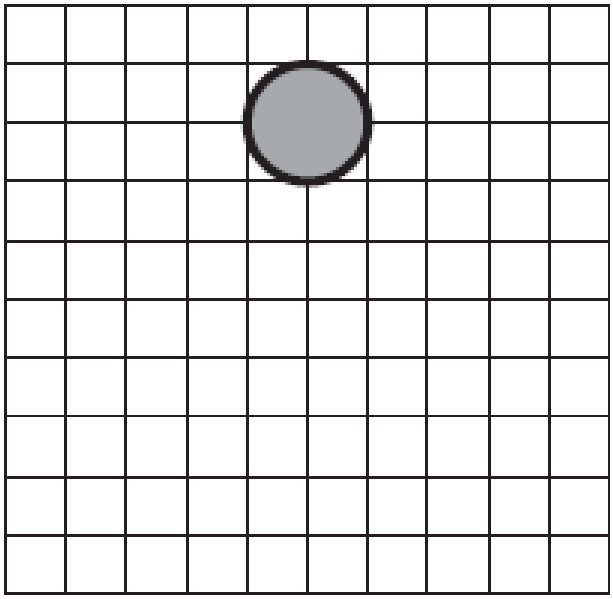
Q4

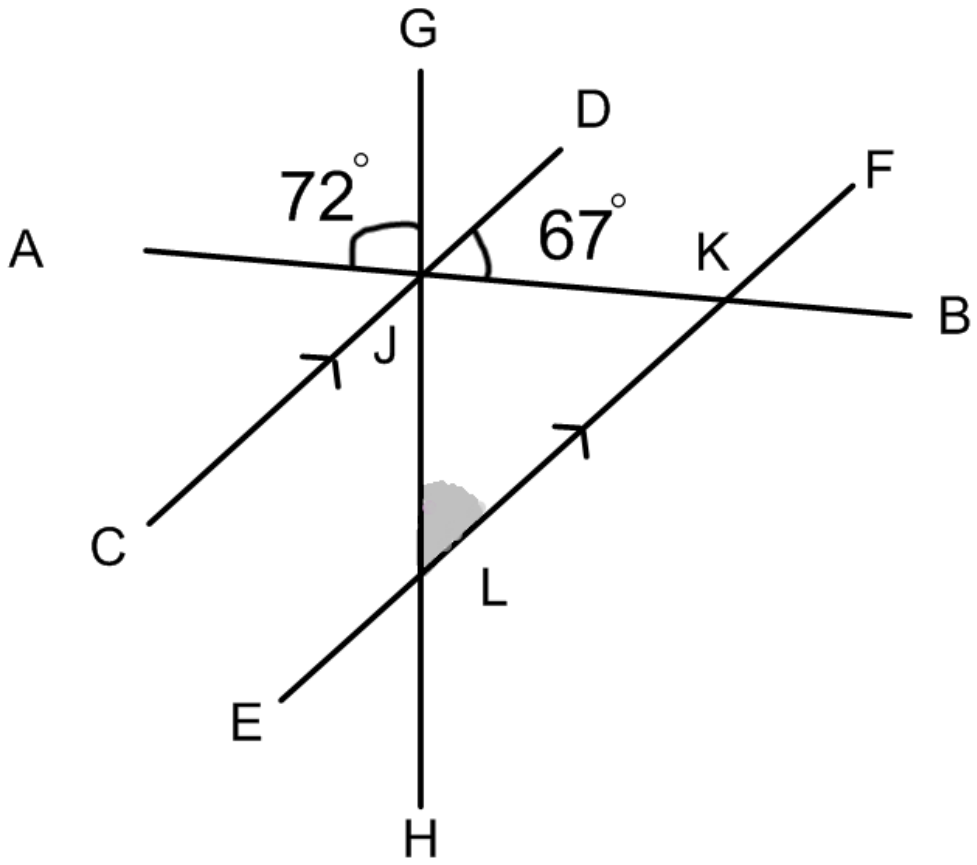
3. Draw this shape on the grid below.

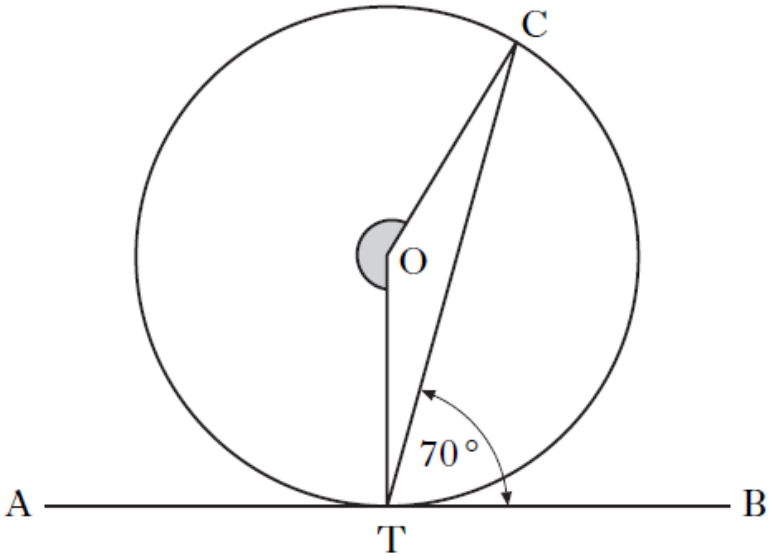
Make each of its lines half as long.

4





Q5	In the diagram below, lines CD and EF are parallel. Lines AB, GH and CD intersect at the point J. Lines AB and EF intersect at the point K and lines EF and GH intersect at the point L. as shown. Lines AB and EF intersect at the point K as shown. Angle AJG is 72° and angle DJB is 67°. Calculate the size of angle GLF°.  	**1**

Q6 P1	9.  In the diagram above: • O is the centre of the circle • AB is a tangent to the circle at T • angle BTC = 70°. Calculate the size of the shaded angle TOC.	**3**

Section A

MARKING SCHEME

Q		Marks
Q1		**4**

8	**Ans:**	**20 · 7 (m)**		
	•1	Correct use of Pythagoras' Theorem	•1	$4 \cdot 3^2 + 2 \cdot 9^2$
	•2	Correct Pythagoras calculation	•2	26·9
	•3	Correct square root of above	•3	5·18…
	•4	Correct multiplication of above by 4	•4	P = 20 · 7 (m) 4K

Note:

For a final answer of 20·7 or 20·8 (4 × 5·2) without working – award 3/4

		Marks
Q2		**4**

5		**Ans:**	**27·5(m)**	**4**	
		•1	correctly use Pythagoras' theorem		•1 $34^2 = x^2 + 20^2$ or equivalent
		•2	correct Pythagoras calculation		•2 $x^2 = 756$
		•3	correct square root of above		•3 $x = 27{\cdot}495$
		•4	correct rounding to 1 decimal point		•4 $x = 27{\cdot}5$
				(KU)	

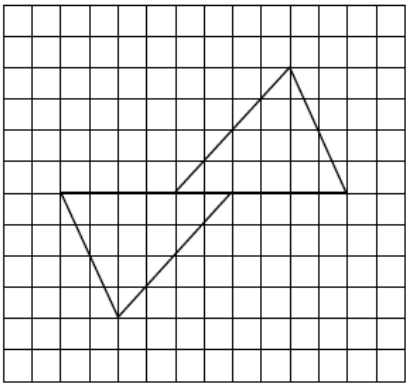
Notes:

(i) Alternative Strategy

- •1 correct trig statement
- •2 correct calculation of angle (54° or 36°)
- •3 correct calculation of length
- •4 correct rounding to 1 decimal place

(ii)

Final Answers	with working	without working
27·5	4/4	3/4
39·4 ($34^2 + 20^2$)	3/4	0/4

Q3	**2** **Ans: Diagram completed** •1 1 line correct •2 for a further 2 lines correct •3 for a further 2 lines correct  **3R**	**3**
Q4	**3** **Ans: correctly completed diagram** •1 start to reduce •2 continue to reduce •3 continue to reduce •4 complete reduction •1 *body* correct •2 *arms* correct •3 *legs* correct •4 *feet* correct **4R**	**4**
Q5	41°	**1**

Section A - Marking Scheme

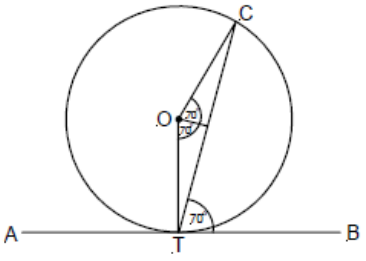
Q6 **3**

9	**Ans: 220(°)**	
	$\bullet^1$ Finds angle CTO	$\bullet^1$ $90 - 70 = 20$
	$\bullet^2$ Finds angle TOC (obtuse)	$\bullet^2$ $180 - (2 \times 20) = 140$
	$\bullet^3$ Finds angle TOC (reflex)	$\bullet^3$ $360 - 140 = 220(°)$ **3R**

Notes:

(i) Alternative solution

$\bullet^1$	Angle TOC bisected	$\bullet^1$	$70 + 70$
$\bullet^2$	Finds angle TOC (obtuse)	$\bullet^2$	140
$\bullet^3$	Finds angle TOC (reflex)	$\bullet^2$	$360 - 140 = 220(°)$

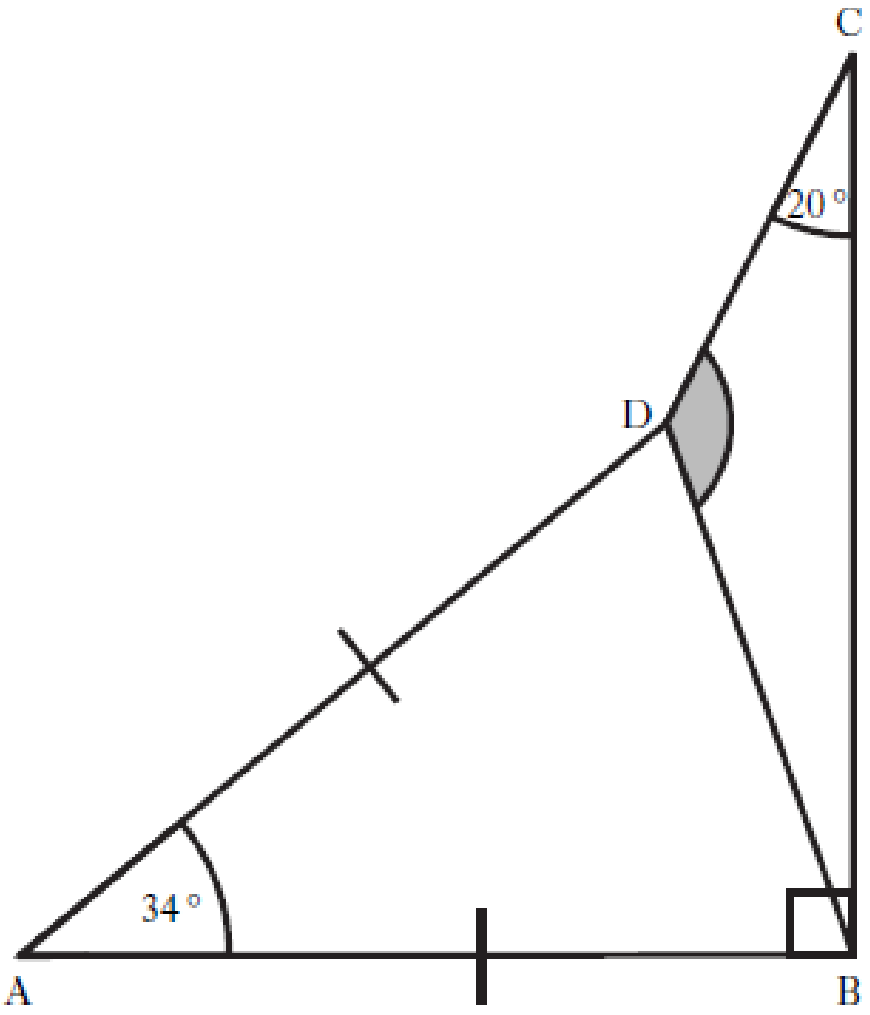


(ii)

Final Answers	with working	without working
220(°)	3/3	2/3
140(°)	2/3	1/3

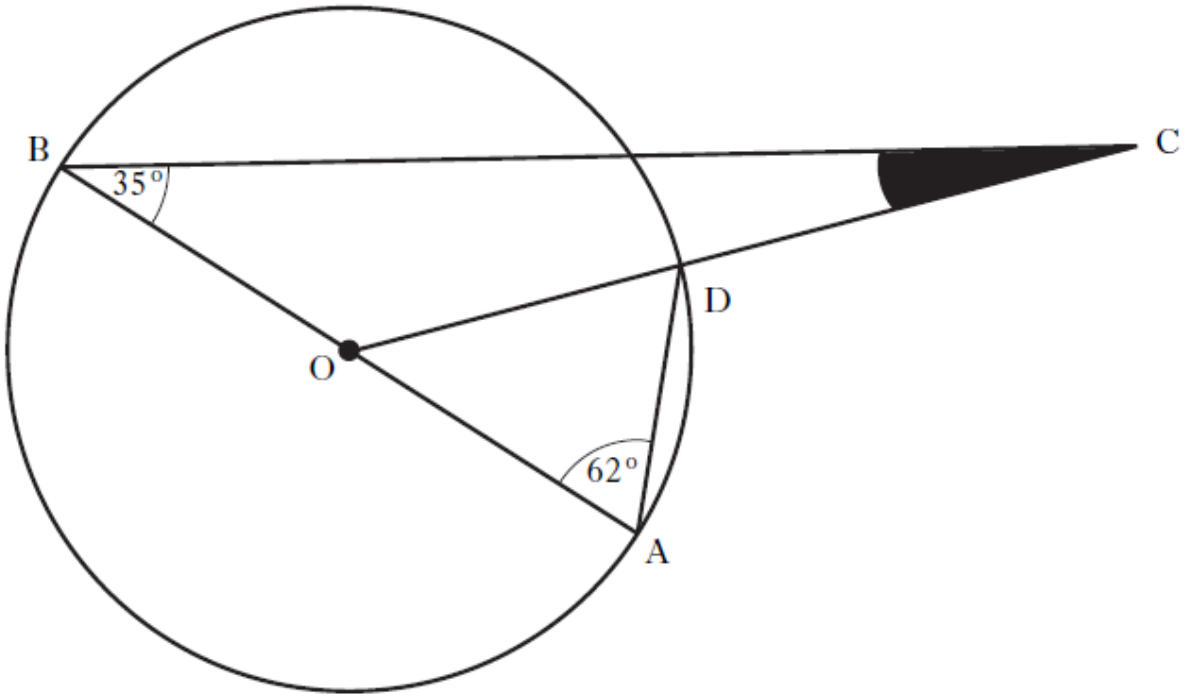
Section B

Section B – Paper 1 – Questions

Q		Marks
1	9. In the diagram below: • triangle ABD is isosceles with AB = AD • angle DAB = 34° • angle ABC = 90° • angle BCD = 20°.  Calculate the size of the shaded angle BDC.	3

2

10.

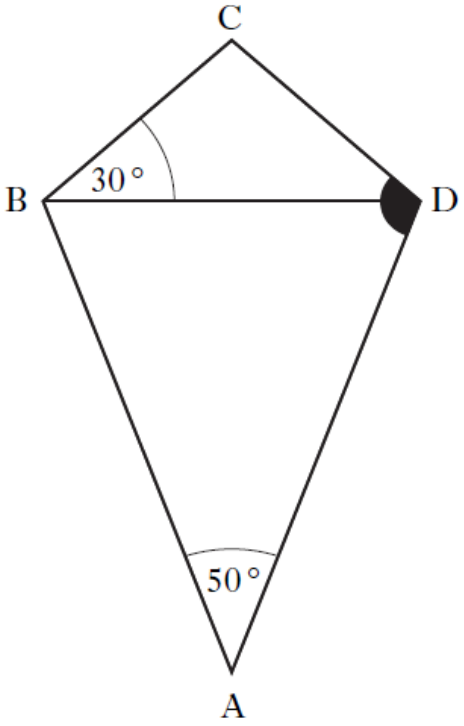
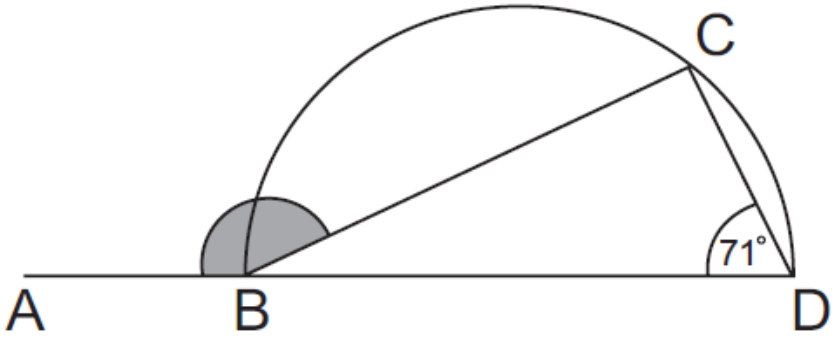


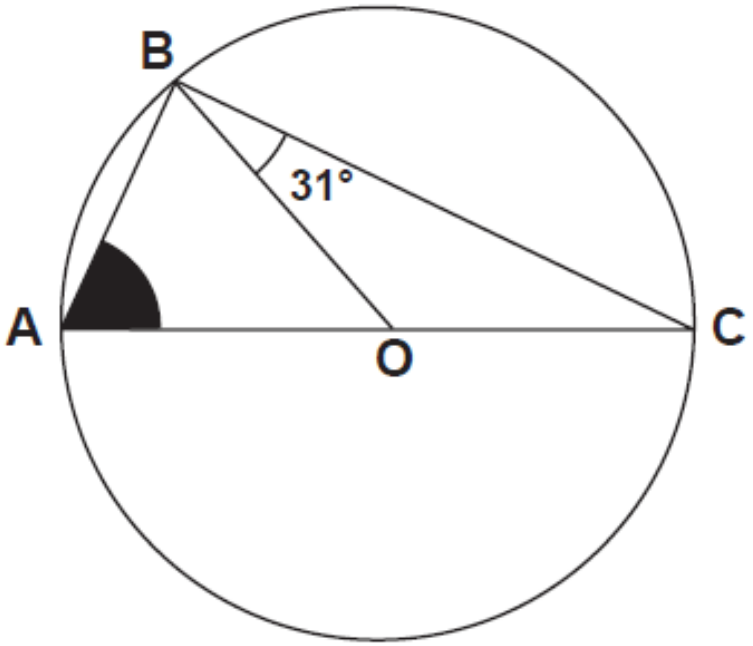
In the diagram above:

- AB is a diameter of the circle with centre O
- OC intersects the circle at D
- Angle ABC = 35°
- Angle BAD = 62°

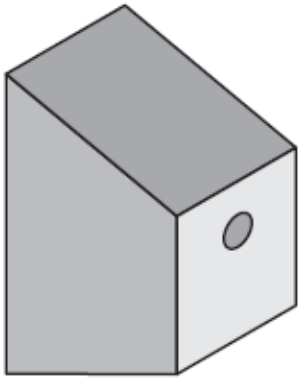
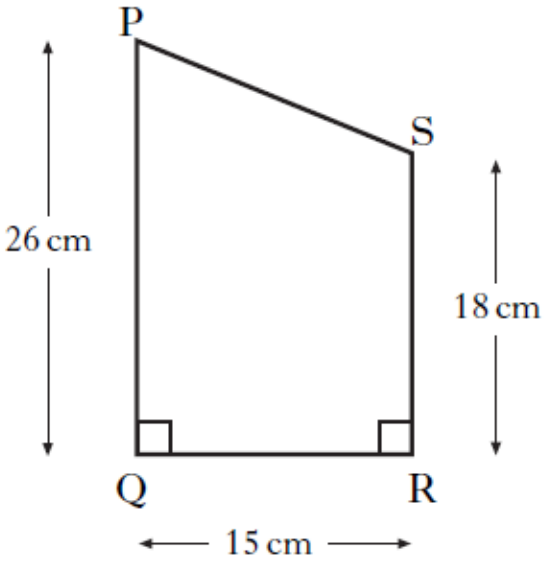
Calculate the size of the shaded angle.

3

3	7. In the diagram: • ABCD is a kite • Angle DAB = 50° • Angle DBC = 30° Calculate the size of shaded angle ADC. 	**3**
4	10.  The diagram above shows a semi-circle with BD as diameter. • C lies on the circumference • In triangle BCD, angle CDB is 71° • AD is a straight line Calculate the size of the shaded angle ABC.	**3**

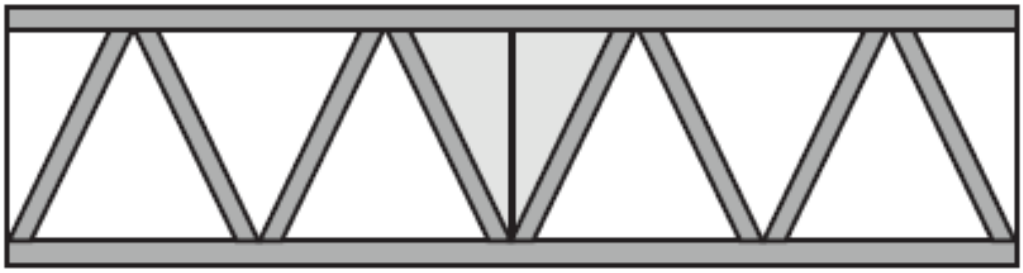
5	9.  The diagram above shows: • AC is a diameter of a circle with centre O • B lies on the circumference • angle OBC = 31°. Calculate the size of the shaded angle BAO.	**3**

Section B – Paper 2 – Questions

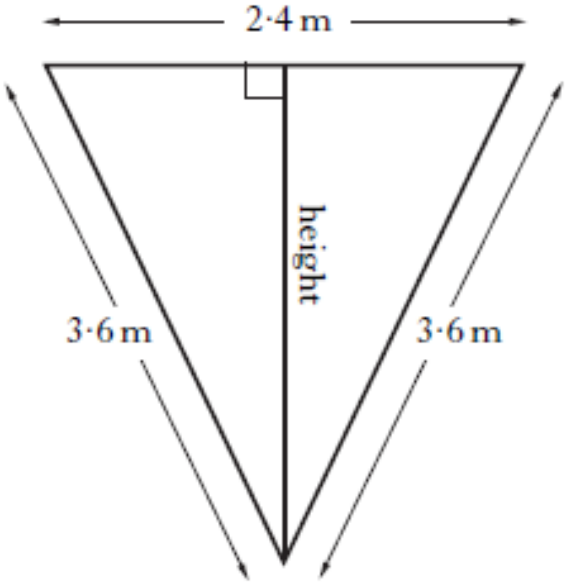
Q		Marks
6	5. Lewis is designing a bird box for his garden. The dimensions for the side of the box are shown in the diagram below.   Calculate the length of side PS. **Do not use a scale drawing.**	4

7

8. A steel plate in the shape of an isosceles triangle is used to strengthen a bridge. **4**



The dimensions of the isosceles triangle are shown below.



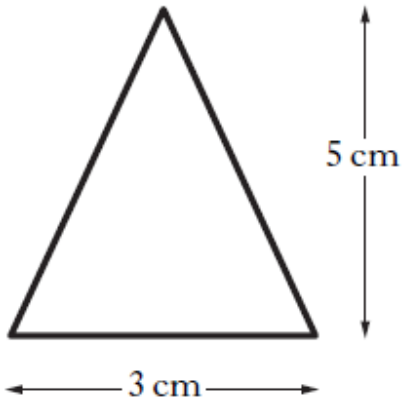
Calculate the height of the steel plate.

Do not use a scale drawing.

8

12. An earring in the shape of an isosceles triangle is made from silver wire.

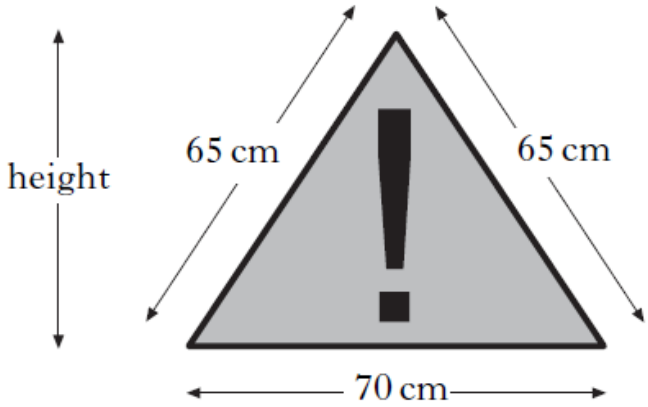
The dimensions of the earring are shown on the diagram below.

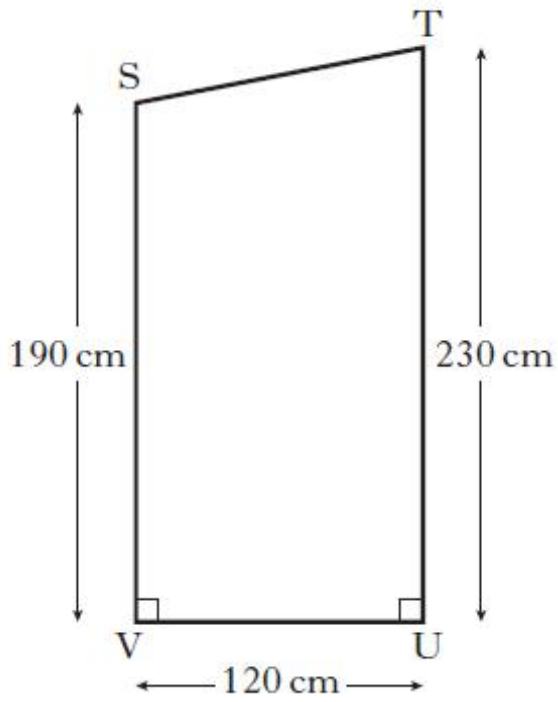


Calculate the length of silver wire needed to make a **pair** of earrings.

Do not use a scale drawing.

4

9	**12.** A warning sign is in the shape of an isosceles triangle.  Calculate the height of the sign.	**4**

10	7. Maggie has bought a garden shed. The dimensions for one side of the shed are shown in the diagram below.   Calculate the length of ST.	**4**

Section B

MARKING SCHEME

Section B – Paper 1 – Marking Scheme

Q 1 — **Marks: 3**

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
9	**Ans: 143°**	
	•[1] using ∠DAB = 34° to calculate ∠ABD	•[1] ∠ABD = ½ (180 – 34)° = 73°
	•[2] using ∠ABC = 90° to calculate ∠CBD	•[2] ∠CBD = 90 – 73 = 17°
	•[3] correct subtraction of angles BCD and CBD from 180°	•[3] ∠BDC = 180 – (17 + 20) = 143°
		3R

Q 2 — **Marks: 3**

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
10	**Ans: 21(°)**	
	•[1] knowing to calculate angle AOD	•[1] 180 – (62 + 62)
	•[2] knowing to calculate angle BOC	•[2] 180 – 56
	•[3] correctly calculate angle BCO	•[3] 180 – (124 + 35) = 21(°)
		3R

NOTE:

(i)	**Final answers**	**with working**	**without working**
	21	3/3	2/3
	24 (from AOD = 59°)	2/3	0/3
	48 (from BOC = 97°)	1/3	0/3

3

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
7	**Ans: 95(°)**	
	•[1] use properties of isosceles triangle to find ∠BDC	•[1] 30°
	•[2] use properties of isosceles triangle to find ∠ADB	•[2] (180° – 50°) ÷ 2 = 65°
	•[3] correct addition of angles	•[3] 65° + 30° = 95(°)
		3R

NOTES:

(i) **Alternative strategy:**

•[1]	use ∠BCA = ∠DCA to find ∠DCA	•[1]	∠DCA = ½ × 120° = 60°
•[2]	use ∠CAB = ∠CAD to find ∠CAD	•[2]	∠CAD = ½ × 50° = 25°
•[3]	correct calculation to find ∠CDA	•[3]	∠CDA = 180° – (60° + 25°) = 95(°)

(ii) For a correct final answer without working award 2/3

3

4

10	**Ans: 161(°)**		
	•[1]	identify < BCD as right angle	•[1] Angle BCD = 90°
	•[2]	use properties of a triangle to find < CBD	•[2] 180° – 90° – 71° = 19°
	•[3]	correct value of shaded angle <ABC	•[3] 180° – 19° = 161(°)
			3R

NOTE:

(i)	**Final Answers**	**With Working**	**Without Working**
	161	3/3	1/3
	142 (from 180 – 2 × 71)	2/3	0/3

3

5

Question	**Marking Scheme Give 1 mark for each •**	**Max Mark**	**Illustrations of evidence for awarding a mark at each •**
9	**Ans: 59 (°)**	**3**	
	•[1] angle ABC identified as right angle		•[1] 90
	•[2] calculate angle ABO		•[2] 90 – 31 = 59
	•[3] calculate angle BAO	**(RE)**	•[3] 59

Notes:

(i) Alternative Strategies

•[1] calculate angle BOC	•[1]	118 (180 – 31 – 31)
•[2] calculate angle BOA	•[2]	62 (180 – 118)
•[3] calculate angle BAO	•[3]	59
•[1] know angle ABC is a right angle	•[1]	90
•[2] strategy (using triangle ABC)	•[2]	180 – 90 – 31
•[3] calculate angle BAO	•[3]	59

(ii)

Final Answer	with working	without working
59	3/3	2/3

3

Section B – Paper 2 – Marking Scheme

<table>
<tr><th>Q</th><th></th><th>Marks</th></tr>
<tr><td>6</td><td>
<table>
<tr><th>Question No</th><th>Give 1 mark for each •</th><th>Illustrations of evidence for awarding each mark •</th></tr>
<tr><td>5</td><td>Ans: 17 (cm)
•1 Knows to find length of short side
•2 Substituting correctly into Pythagoras theorem
•3 Knowing to find the square root of above
•4 All calculations correct within a valid strategy</td><td>
•1 26 – 18 = 8
•2 $PS^2 = 8^2 + 15^2$
•3 $PS = \sqrt{289}$
•4 PS = 17 (cm)
4R</td></tr>
<tr><td colspan="3">Note:
<table>
<tr><th>Final Answers</th><th>with working</th><th>without working</th></tr>
<tr><td>17</td><td>4/4</td><td>2/4</td></tr>
<tr><td>30(.01) $(26^2 + 15^2)$</td><td>3/4</td><td>0/4</td></tr>
<tr><td>23.4 $(18^2 + 15^2)$</td><td>3/4</td><td>0/4</td></tr>
<tr><td>31.6 $(26^2 + 18^2)$</td><td>1/4</td><td>0/4</td></tr>
<tr><td>289</td><td>2/4</td><td>1/4</td></tr>
</table></td></tr>
</table>
</td><td>4</td></tr>
<tr><td>7</td><td>
<table>
<tr><td>8</td><td>Ans: 3·3 (m)
•1 knowing to half base
•2 knowing to use Pythagoras
•3 correct form of Pythagoras
•4 correct calculation must include a square root</td><td>
•1 ½ × 2·4 (= 1·2)
•2 $3{\cdot}5^2 = h^2 + 1{\cdot}2^2$
•3 $h^2 = 3{\cdot}5^2 - 1{\cdot}2^2$
•4 h = 3·3 (m)
4R</td></tr>
</table>
</td><td>4</td></tr>
</table>

8

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
12	**Ans: 26·8 (cm)**	
	•1 knowing to find length of short side	•1 $3 \div 2 = 1{\cdot}5$
	•2 knowing to use Pythagoras	•2 $x^2 = 5^2 + 1{\cdot}5^2$
	•3 correct Pythagoras calculation	•3 $x = 5{\cdot}2$
	•4 correct length calculation	•4 $(5{\cdot}2 + 5{\cdot}2 + 3) \times 2 = 26{\cdot}8$(cm) **4R**

NOTE:

(i)

Final answers	with working	without working
26·8	4/4	3/4
29·2 (from $5^2 + 3^2$)	3/4	0/4
22 (from $5^2 - 3^2$)	2/4	0/4
26 (from $(5 + 5 + 3) \times 2$)	1/4	0/4
12·5 (from $5^2 - 1{\cdot}5^2$)	3/4	0/4

4

9

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
12	**Ans: 54·8(cm)**	
	•1 knowing to halve base	•1 35
	•2 correct Pythagoras statement	•2 $x^2 = 65^2 - 35^2$
	•3 knowing to find square root	•3 $\sqrt{3000}$
	•4 all calculations correct	•4 54·8(cm) **4R**

NOTES:

Final answers	with working	without working
54·8	4/4	3/4
55	4/4	3/4
73·8 ($65^2 + 35^2$)	3/4	0/4
26 ($70^2 - 65^2$)	2/4	0/4
95·5 ($70^2 + 65^2$)	2/4	0/4

4

10

Question No	Give 1 mark for each •	Illustrations of evidence for awarding each mark
7	**Ans: 126(·5) (cm)**	
	•[1] finding length of short side	•[1] 230 – 190 (= 40)
	•[2] correct Pythagoras statement	•[2] $120^2 + 40^2$
	•[3] knowing to calculate square root	•[3] $\sqrt{16\,000}$
	•[4] all calculations correct, within a right angled triangle	•[4] 126(·5) (cm) **4R**

NOTE:

(i) Final Answers	With Working	Without Working
126(·5)	4/4	2/4
113·1 ($120^2 – 40^2$)	3/4	0/4
259·4 ($230^2 + 120^2$)	3/4	0/4
224·7 ($190^2 + 120^2$)	3/4	0/4
196·2 ($230^2 – 120^2$)	2/4	0/4
147·3 ($190^2 – 120^2$)	2/4	0/4

4