MyWeekbook

BETTER AT SCHOOL. WEEK BY WEEK.

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WeekBook: MATHEMATICS

Topics: trigonometry • exact values • multi-step geometry • statistics • histograms

Study routine: 20 minutes of focused work -> 5-minute break -> 20 minutes of focused work. The final 5 minutes are for active self-correction and a final review.

Electronic devices such as computers and mobile phones must be kept away from the student during study time.

Materials: notebook, pencil, ruler, a second-colour pen for self-correction, graphing/scientific calculator in DEG mode.

Goals for the 7 days

- **Consolidate the key trigonometry formulas and essential exact values.**
- **Solve multi-step geometry problems methodically and check the result.**
- **Read data and histograms confidently, avoiding blank answers.**

Main topics:

1. Trigonometry: SOH-CAH-TOA, sine/cosine/tangent, inverse functions, Sine Rule and Cosine Rule.
2. Exact values and the unit circle: know, for example, that cos 0° = 1 and sin 270° = -1, and understand why.
3. Multi-step geometry: connect Pythagoras/trigonometry with arcs and sectors without losing precision from one step to the next.
4. Statistics and histograms: read data, median, range, IQR, frequency density and compare distributions.
5. Exam strategy: avoid blank answers; if you are stuck, write the formula, data and first step, then move on.

Fixed structure for each day

When	Activity	Duration
0-4 min	Warm-up / recall from the previous day	4 min
4-14 min	Core theory	10 min
14-20 min	Guided examples	6 min
20-25 min	**BREAK**	5 min
25-36 min	Independent practice	11 min
36-40 min	Challenge problem / application	4 min
40-45 min	Active self-correction	5 min

“90-second” strategy. If after about 90 seconds you do not know how to continue, do not leave the answer blank: write the data, formula or diagram, complete the first step you know, add a ★ and move on.
When to return to the ★. Return to starred questions only after completing the ones you know how to do. In MYP problems, a correct setup and clear communication can earn marks even if you do not complete the final answer.

DAY 1 - Pythagoras + checking your answer

Goal: apply Pythagoras' theorem confidently, choose addition or subtraction correctly and check that the answer is reasonable.

0-4 min | Warm-up | 4 min

1. Calculate mentally: 32^2 and 40^2.

2. Without a calculator: between which two integers does $\sqrt{2624}$ lie?

3. True or false: with legs of 32 cm and 40 cm, could the hypotenuse be 34.76 cm? Justify your answer in one line.

4-14 min | Core theory | 10 min

1. When to use it. Pythagoras' theorem applies only to right-angled triangles, i.e. triangles with a 90° angle. The side opposite the right angle is the hypotenuse c: it is always the longest side. The other two sides are the legs a and b.
2. Core formula. $c^2 = a^2 + b^2$. To find the hypotenuse: $c = \sqrt{(a^2+b^2)}$. To find a leg: $a = \sqrt{(c^2-b^2)}$ or $b = \sqrt{(c^2-a^2)}$.
3. Squaring and square roots. The square root reverses squaring: if $x^2 = 144$ and x represents a length, $x = \sqrt{144} = 12$. The square root must include the entire sum or difference.
4. Working sequence. Draw/read the triangle -> identify the hypotenuse -> write the formula -> substitute the numbers using brackets -> calculate squares and the sum/difference -> take the square root -> add units.
5. Calculator. For $\sqrt{(32^2+40^2)}$, enter the square root of the entire expression, not $\sqrt{32^2} + 40^2$. Keep all digits during the calculation and round only at the end.
6. Quick checks. If you are finding the hypotenuse, the answer must be greater than both legs but less than their sum. If you are finding a leg, the answer must be less than the hypotenuse.
Example. With legs 6 and 8: $c = \sqrt{(6^2+8^2)} = \sqrt{(36+64)} = \sqrt{100} = 10$.

14-20 min | Guided examples | 6 min

4. Legs 32 m and 40 m. Write the formula, calculate the hypotenuse and check that the result is reasonable.

5. Hypotenuse 13 cm and one leg 5 cm. Find the other leg and check the result.

BREAK - 5 minutes (from minute 20 to minute 25)
Stand up, have a drink, no maths and, if possible, no phone.

25-36 min | Independent practice | 11 min

6. Legs 9 cm and 12 cm: find c.

7. Legs 7 cm and 24 cm: find c.

8. Legs 15 cm and 20 cm: find c.

9. c = 17 cm and b = 8 cm: find a.

10. c = 25 cm and b = 24 cm: find a.

11. Legs 11 cm and 14 cm: find c to 2 decimal places and state between which two integers it must lie.

36-40 min | Challenge problem | 4 min

12. A rectangular screen measures 18 cm × 24 cm. What is the length of the diagonal? Also write a check showing that the result is reasonable.

40-45 min | Active self-correction | 5 min

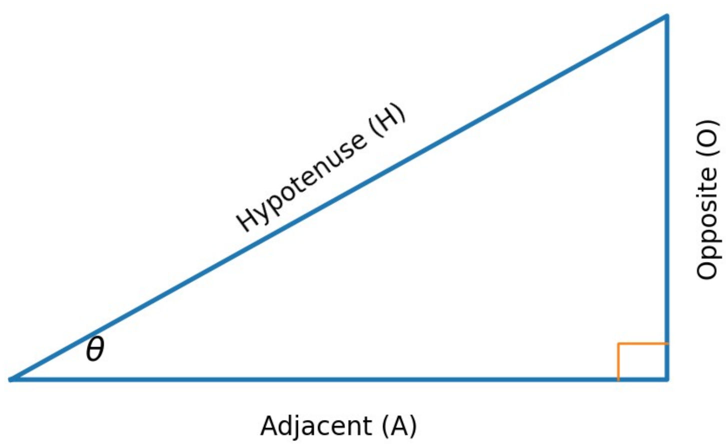
DAY 2 - Trigonometry in right-angled triangles

Goal: identify H, O and A relative to the chosen angle, select sin/cos/tan and use inverse functions to find an angle.

0-4 min | Warm-up | 4 min

1. Write the three SOH-CAH-TOA relationships without looking at your notes.

2. In a right triangle, which side is always H?



4-14 min | Core theory | 10 min

1. Side names. H = hypotenuse: the side opposite 90°, always the longest. O = opposite: the side opposite angle θ. A = adjacent: the leg touching θ. O and A change if the reference angle changes; H does not.
2. SOH-CAH-TOA. $\sin\theta = O/H$; $\cos\theta = A/H$; $\tan\theta = O/A$. Choose the relationship containing the known side and the side/unknown you are looking for.
3. Finding a side. If $\sin 35° = x/12$, then $x = 12\cdot\sin 35°$. If $\cos 52° = 9/H$, then $H = 9/\cos 52°$. Always write the relationship before substituting the numbers.
4. Finding an angle. First form a ratio, then use the inverse function: if $\tan\theta = 5/12$, then $\theta = \tan^{-1}(5/12)$. The $\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$ keys return an angle.
5. DEG mode. For questions in degrees, the calculator must display DEG. If it is in RAD mode, the angle obtained will be wrong.
6. Checks. The acute angles in a right triangle are between 0° and 90°. Also, O/H and A/H must be between 0 and 1.
Example. O=9, H=15: $\sin\theta = 9/15 = 0.6$; $\theta = \sin^{-1}(0.6) \approx 36.87°$.

14-20 min | Guided examples | 6 min

3. θ = 35°, H = 12 cm. Find O.

4. O = 9 cm and H = 15 cm. Find θ.

BREAK - 5 minutes (from minute 20 to minute 25)
Stand up, have a drink, no maths and, if possible, no phone.

25-36 min | Independent practice | 11 min

5. θ = 52°, A = 9 cm. Find H.

6. θ = 28°, O = 7 cm. Find A.

7. O = 9 cm, H = 15 cm. Find θ.

8. A = 12 cm, H = 13 cm. Find θ.

9. O = 5 cm, A = 12 cm. Find θ.

10. For each exercise above, write SOH / CAH / TOA before doing the calculation.

36-40 min | Challenge problem | 4 min

11. From a point on the ground 14 m from the base of a tree, the angle of elevation to the top is 38°. Estimate the height of the tree. Draw the triangle first.

40-45 min | Active self-correction | 5 min

DAY 3 - Exact values, unit circle and quadrants

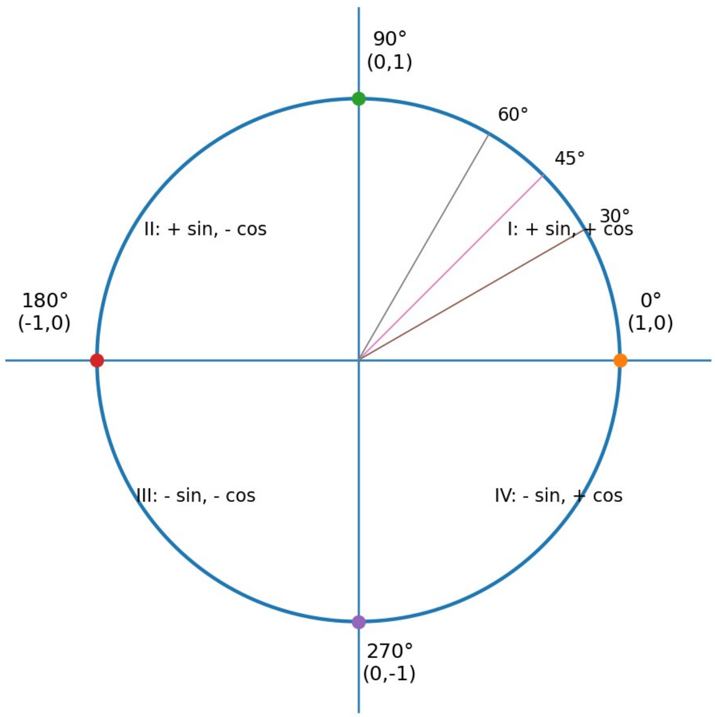
Goal: know the key exact values, read sine and cosine from the unit circle and determine the sign in all four quadrants.

0-4 min | Warm-up | 4 min

1. Complete without a calculator: sin 0° = ___ ; cos 0° = ___ ; sin 90° = ___ ; cos 180° = ___.

2. Complete: sin 270° = ___ ; cos 270° = ___ ; cos 360° = ___.

4-14 min | Core theory | 10 min



1. Unit circle. It is a circle of radius 1 centred at the origin. Each angle θ corresponds to a point P with coordinates P=(cos θ, sin θ). Therefore cos θ is the x-coordinate and sin θ is the y-coordinate.
2. Angles on the axes. 0° -> (1,0); 90° -> (0,1); 180° -> (-1,0); 270° -> (0,-1); 360° -> (1,0). Therefore: cos0°=1, sin90°=1, cos180°=-1, sin270°=-1, cos360°=1.
3. Values at 30°, 45° and 60°. They come from special triangles. For 45°: sin45°=cos45°=√2/2. For 30° and 60°: sin30°=1/2, cos30°=√3/2, sin60°=√3/2, cos60°=1/2.
4. Tangent. tan θ = sin θ / cos θ. Therefore tan45°=1. When cos θ=0, tangent is undefined: this happens at 90° and 270°.
5. Signs in the quadrants. I: sin, cos and tan are positive. II: sin is positive, cos and tan are negative. III: tan is positive, sin and cos are negative. IV: cos is positive, sin and tan are negative.
6. Reference angle. For angles such as 135°, use the related acute angle: 135° = 180°-45°. The absolute value is the 45° value, then choose the sign from the quadrant: cos135° = -√2/2.

	0°	30°	45°	60°	90°	180°	270°	360°
sin θ	0	1/2	√2/2	√3/2	1	0	-1	0
cos θ	1	√3/2	√2/2	1/2	0	-1	0	1

tan θ	0	√3/3	1	√3	undefined	0	undefined	0

14-20 min | Guided examples | 6 min

3. Explain in one sentence WHY cos 0° = 1 using the coordinates on the unit circle.

4. Explain in one sentence WHY sin 270° = -1.

5. Use a reference angle: is cos 135° positive or negative? What is its exact value?

BREAK - 5 minutes (from minute 20 to minute 25)
Stand up, have a drink, no maths and, if possible, no phone.

25-36 min | Independent practice | 11 min

6. sin 30° = ____________________
7. cos 60° = ____________________
8. sin 45° = ____________________
9. cos 45° = ____________________
10. tan 45° = ____________________
11. cos 180° = ____________________
12. sin 270° = ____________________
13. cos 270° = ____________________
14. tan 90° = ____________________
15. sin 360° = ____________________
16. cos 360° = ____________________
17. tan 270° = ____________________

36-40 min | Challenge problem | 4 min

18. For 0° ≤ θ ≤ 360°, find all solutions: (a) sin θ = 1/2; (b) cos θ = -√2/2; (c) tan θ = -1.

40-45 min | Active self-correction | 5 min

DAY 4 - Sine Rule and Cosine Rule

Goal: choose between the Sine Rule and Cosine Rule in non-right-angled triangles and calculate sides and angles using correct notation.

0-4 min | Warm-up | 4 min

1. In a triangle A+B+C=180°. If A=35° and B=117°, find C.

2. Write: when should you use the Sine Rule? When should you use the Cosine Rule?

4-14 min | Core theory | 10 min

1. Notation. In triangle ABC, side a is opposite angle A, b is opposite B and c is opposite C. Before using a formula, always match each side with its opposite angle.
2. Angle sum. A+B+C=180°. If you know two angles, find the third immediately before choosing the rule.
3. Sine Rule. a/sinA = b/sinB = c/sinC. Use it when you have at least one complete opposite side-angle pair and need to find another side or angle.
4. Cosine Rule for a side. $a^2 = b^2+c^2-2bc\cdot\cos A$. It is especially useful with two sides and the included angle (SAS). At the end: a = √(result).
5. Cosine Rule for an angle. $\cos A = (b^2+c^2-a^2)/(2bc)$. It is useful when you know all three sides (SSS). Then $A = \cos^{-1}$(the ratio).
6. How to choose. Known opposite pair -> think Sine Rule. Three sides, or two sides + included angle -> think Cosine Rule.
7. Check. The longest side must be opposite the largest angle. The angles must add up to 180°.
Sine Rule example. If A=35°, B=117°, b=54: a = 54·sin35°/sin117° ≈ 34.76.

14-20 min | Guided examples | 6 min

3. A=35°, B=117°, b=54 cm. Find a using the Sine Rule. (This is deliberately similar to a question that went well in the test.)

4. b=7 cm, c=10 cm, A=42°. Find a using the Cosine Rule.

BREAK - 5 minutes (from minute 20 to minute 25)
Stand up, have a drink, no maths and, if possible, no phone.

25-36 min | Independent practice | 11 min

5. A=48°, a=12 cm, B=71°. Find b.

6. Sides b=9 cm, c=12 cm and included angle A=65°. Find a.

7. Sides a=14 cm, b=9 cm, c=12 cm. Find angle A.

8. Decide WITHOUT calculating: Sine Rule or Cosine Rule? Given A=32°, B=81°, a=10.

9. Decide WITHOUT calculating: Sine Rule or Cosine Rule? Given b=8, c=11, A=53°.

10. Decide WITHOUT calculating: Sine Rule or Cosine Rule? Given a=7, b=10, c=12.

36-40 min | Challenge problem | 4 min

11. A triangle has sides 8 m, 11 m and 13 m. Find the angle opposite the 13 m side. Write the formula, substitution, cosine value and final angle.

40-45 min | Active self-correction | 5 min

DAY 5 - Multi-step problems: triangles, arcs and sectors

Goal: solve multi-step geometry problems linking chords, Pythagoras, trigonometry, central angles, arcs and sectors.

0-4 min | Warm-up | 4 min

1. Write the formulas for arc length and sector area.

2. If $r=10$ cm and $\theta=180°$, what is the arc length?

4-14 min | Core theory | 10 min

1. Chord and centre. A perpendicular drawn from the centre of a circle to a chord divides the chord into two equal parts. If $AB=80$ and M is the midpoint, $AM=BM=40$.
2. Hidden right triangle. Centre E, midpoint M and endpoint B form a right triangle EMB. If you know EM and BM, radius EB can be found using Pythagoras.
3. Central angle. First find angle BEM in the right triangle using sin/cos/tan. By symmetry, if M bisects the chord, the full angle AEB is often $2\cdot BEM$.
4. Arc length. arc length = $(\theta/360°)\cdot 2\pi r$. The fraction $\theta/360$ shows what proportion of the full circumference you are using.
5. Sector area. sector area = $(\theta/360°)\cdot \pi r^2$. Use the same central angle θ.
6. Minor and major arcs. If $\theta<180°$, the formula gives the minor arc. The angle for the major arc is $360°-\theta$.
7. Multi-step procedure. 1) draw and label; 2) find the radius/side; 3) find the angle; 4) apply the arc/sector formula; 5) check units. Keep the full value in the calculator between steps.
Check. A minor arc must be shorter than the circumference $2\pi r$; a sector must have an area less than πr^2.

14-20 min | Guided example | 6 min

3. In a circle, chord AB is 80 m long. M is its midpoint and $EM=30$ m, with E as the centre. (a) Find radius EB. (b) Find angle AEB. (c) Find the length of minor arc AB.

BREAK - 5 minutes (from minute 20 to minute 25)
Stand up, have a drink, no maths and, if possible, no phone.

25-36 min | Independent practice | 11 min

4. Chord $CD=48$ cm; distance from the centre to the midpoint of the chord $=7$ cm. Find the radius, central angle and minor arc CD.

5. A sector has radius 12 cm and angle 135°. Find: (a) arc length; (b) sector area. Give the exact form with π and an approximation.

36-40 min | Challenge problem | 4 min

6. A circular sector has radius 13 m. Its central angle equals angle A of a triangle with sides a=13 m, b=8 m, c=11 m. Find A using the Cosine Rule, then find the arc length of the sector.

40-45 min | Active self-correction | 5 min

DAY 6 - Statistics: centre, spread and comparison

Goal: calculate and interpret median, range, quartiles and IQR, and write statistical comparisons that distinguish evidence from conclusions.

0-4 min | Warm-up | 4 min

1. Define in simple words: median, range and interquartile range (IQR).

4-14 min | Core theory | 10 min

1. Order the data first. Median and quartiles are calculated using data ordered from smallest to largest.
2. Median. With an odd number of data values, it is the middle value. With an even number, it is the mean of the two middle values.
3. Range. range = maximum - minimum. It describes the total spread but is strongly affected by extreme values.
4. Quartiles and IQR. Q1 is the median of the lower half; Q3 is the median of the upper half; IQR=Q3-Q1. With 15 data values, find the median (8th value), exclude it, then find the median of the 7 lower values and the 7 upper values.
5. Interpretation. A higher median indicates a higher typical result. A smaller IQR indicates that the middle 50% of the data is more tightly clustered.
6. Comparing two groups. Write at least one sentence about the centre (median/mean) and one about spread (range/IQR). Use numbers as evidence: “Group A has a higher median..., while Group B has a larger IQR...”.
7. Do not confuse association with causation. If one group has better results, this does not automatically prove that the treatment caused the improvement. How the groups were formed, sample size and other variables also matter.

14-20 min | Guided example | 6 min

App group data: 45, 52, 53, 57, 64, 65, 66, 68, 70, 73, 75, 77, 81, 89, 92

Book group data: 37, 39, 40, 42, 44, 46, 50, 55, 56, 57, 58, 69, 71, 79, 83

2. Calculate the median and range of the App group.

3. Calculate the median and range of the Book group.

BREAK - 5 minutes (from minute 20 to minute 25)
Stand up, have a drink, no maths and, if possible, no phone.

25-36 min | Independent practice | 11 min

4. Calculate Q1, Q3 and IQR for both groups.

5. Which group has the higher typical result? Use the median as evidence.

6. Which group is more spread out? Compare the range and IQR.

7. Write 2 complete sentences comparing the App group and the Book group.

36-40 min | Challenge problem | 4 min

8. A classmate says: “The app is definitely better because its median is higher.” Explain why this conclusion is too strong: give at least one limitation of the comparison.

40-45 min | Active self-correction | 5 min

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DAY 7 - Histograms and frequency density

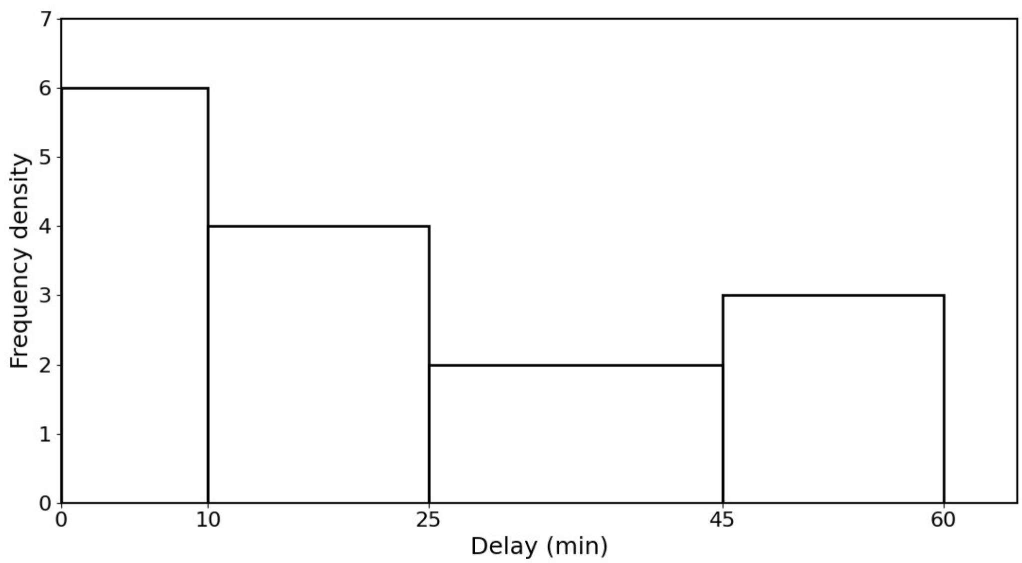
Goal: read and construct histograms with unequal class widths using class width, frequency and frequency density correctly.

0-4 min | Warm-up | 4 min

1. Find the class widths: 0-10, 10-25, 25-45, 45-60.

4-14 min | Core theory | 10 min

1. What is a histogram? It represents continuous quantitative data grouped into intervals. The bars touch because the intervals are continuous.
2. Class width. class width = upper boundary - lower boundary. For 10-25, the width is 15.
3. Frequency density. frequency density = frequency / class width. Therefore frequency = frequency density · class width.
4. Area concept. In a histogram with frequency density on the vertical axis, bar area = width · density = frequency. Therefore, when class widths are different, bar height alone does NOT show how many data values the class contains.
5. Reading a bar. Identify the interval on the x-axis -> calculate the width -> read the density on the y-axis -> multiply width·density.
6. Total number of data values. Calculate the frequency of each class, then add all the frequencies.
7. Constructing a histogram. If you know frequency and class width, calculate the density for each class. The density becomes the bar height.
Example. Class 10-25: width=15, density=4 -> frequency=15·4=60.



14-20 min | Guided examples | 6 min

2. For the 10-25 min class, width=15 and density=4. Find the frequency.

3. For the 25-45 min class, find the frequency.

BREAK - 5 minutes (from minute 20 to minute 25)
Stand up, have a drink, no maths and, if possible, no phone.

25-36 min | Independent practice | 11 min

4. Calculate the frequency of all four classes.

5. How many flights are represented in total?

6. How many delays are at least 45 minutes?

7. Which interval has the highest frequency density? Which has the highest frequency? Must they be the same interval?

36-40 min | Challenge problem | 4 min

8. Work out the bar heights for a histogram using this table: 0-5: f=20; 5-15: f=30; 15-35: f=40. First calculate the three frequency densities.

40-45 min | Active self-correction | 5 min

Final formula sheet - quick review

Trigonometry

SOH: sin θ=O/H   CAH: cos θ=A/H   TOA: tan θ=O/A

Sine Rule: a/sin A = b/sin B = c/sin C

Cosine Rule: $a^2=b^2+c^2-2bc\cos A$ | $\cos A=(b^2+c^2-a^2)/(2bc)$

Essential exact values

	0°	30°	45°	60°	90°	180°	270°	360°
sin	0	1/2	√2/2	√3/2	1	0	-1	0
cos	1	√3/2	√2/2	1/2	0	-1	0	1

Circles and histograms

Arc length=$(\theta/360)\cdot 2\pi r$ Sector area=$(\theta/360)\cdot \pi r^2$

Frequency density=frequency/class width ⇒ frequency=density×class width

Algebra

$(a-b)(a+b)=a^2-b^2$.   If AB=0, then A=0 or B=0.

Error-prevention checks

☐ The hypotenuse must be the longest side.
☐ An acute angle in a right triangle is between 0° and 90°.
☐ In a histogram, frequency is the bar area when class widths are different.
☐ Do not round intermediate results.
☐ Before submitting: leave no answer blank if you can at least write the formula/data.

Self-correction solutions - open only during the final 5 minutes

HOW TO USE THE SOLUTIONS. Open this section only during the final 5 minutes. First compare the result, then find the first incorrect step. Do not copy the worked solution: cover it and redo the exercise from that point.

Priority. Correct no more than two mistakes per day. Mark the others with a ★ and revisit them in the next warm-up.

Day 1

1) 1024; 1600. 2) between 51 and 52. 3) False: the hypotenuse must be >40.
4) $\sqrt{2624} \approx 51.22$ m. 5) 12 cm.
6) 15 cm. 7) 25 cm. 8) 25 cm. 9) 15 cm. 10) 7 cm. 11) $\sqrt{317} \approx 17.80$ cm.
12) 30 cm.

Day 2

3) 6.88 cm. 4) 36.87°. 5) 14.62 cm. 6) 13.17 cm. 7) 36.87°. 8) 22.62°. 9) 22.62°.
11) height ≈ 10.94 m.

Day 3

1) 0; 1; 1; -1. 2) -1; 0; 1.
5) $\cos 135° = -\sqrt{2}/2$.
6-17) 1/2; 1/2; $\sqrt{2}/2$; $\sqrt{2}/2$; 1; -1; -1; 0; undefined; 0; 1; undefined.
18) (a) 30°,150°. (b) 135°,225°. (c) 135°,315°.

Day 4

1) 28°. 3) 34.76 cm. 4) 6.71 cm.
5) 15.27 cm. 6) a≈11.56 cm. 7) A≈82.28°. 8) Sine Rule. 9) Cosine Rule. 10) Cosine Rule.
11) A≈84.78°.

Day 5

2) $10\pi \approx 31.42$ cm.
3) r=50 m; central angle≈106.26°; arc≈92.73 m.
4) r=25 cm; central angle≈147.48°; arc≈64.35 cm.
5) arc=$9\pi \approx 28.27$ cm; area=$54\pi \approx 169.65$ cm².
6) A≈84.78°; arc≈19.24 m.

Day 6

2) App: median=68; range=47. 3) Book: median=55; range=46.
4) App: Q1=53, Q3=77, IQR=24. Book: Q1=42, Q3=69, IQR=27.
5) App group. 6) The ranges are almost the same; the Book group has a slightly larger IQR.
8) A higher median describes the centre, but by itself it does not prove that the app “causes” better results; experimental controls and other measures are needed.

Day 7

1) 10; 15; 20; 15.
2) 60. 3) 40.
4) 60, 60, 40, 45. 5) 205. 6) 45.
7) highest density: 0-10; highest frequency: 0-10 and 10-25 tied (60). They are not necessarily the same interval.
8) densities: 4; 3; 2.

Error log - to be completed during the 7 days

In the log, do not simply write “I made a calculation mistake”. Use the code: F=formula; I=identification; A=algebra; C=calculation/calculator; G=graph/data; U=units/rounding; V=blank/incomplete answer. Then write the rule that will prevent the same mistake next time.

Day	Error type (F/I/A/C/G/U/V)	Correction / rule to remember	Redone?
1			☐ yes ☐ no
2			☐ yes ☐ no
3			☐ yes ☐ no
4			☐ yes ☐ no
5			☐ yes ☐ no
6			☐ yes ☐ no
7			☐ yes ☐ no