Answers - Angles and parallel lines

Year: Year 7

Answer to Question 1

a. Angles on a straight line add up to 180°, so $x = 180 - 112 =$**68°**.
b. The three angles lie on a straight line, so they add up to 180°: $y = 180 - 48 - 75 =$**57°**.
c. Angles around a point add up to 360°: $130 + 95 + 70 = 295$, so $z = 360 - 295 =$ **65°**.
d. The ratio 2 : 7 has $2 + 7 = 9$ parts, and the angles on a line make 180°. One part is $180 \div 9 = 20^{\circ}$, so the angles are 2×20 and 7×20: **40° and 140°**.

Answer to Question 2

a. Angles in a triangle add up to 180°: $180 - 52 - 68 =$**60°**. All three angles are different and less than 90°, so it is an acute scalene triangle.
b. $180 - 90 - 35 =$**55°**. One angle is 90°, so it is a right-angled triangle.
c. The two base angles share $180 - 40 = 140^{\circ}$ equally: $140 \div 2 =$**70°** each.
d. In an isosceles triangle the base angles are equal, so the other base angle is **72°**. The top angle is $180 - 72 - 72 =$**36°**.

Answer to Question 3

a. Angles in a quadrilateral add up to 360°: $360 - 85 - 110 - 95 =$**70°**.
b. In a parallelogram opposite angles are equal, so one other angle is **65°**. Neighbouring angles add up to 180°, so the other two are $180 - 65 =$**115°** each.
c. The angles of the kite add up to 360°: $q = 360 - 120 - 70 - 70 =$**100°**.
d. Angles in a quadrilateral add up to 360°: $360 - 90 - 90 - 54 =$**126°**. It also pairs with 54° as co-interior angles: $54 + 126 = 180$.

Answer to Question 4

a. a and 65° lie on the same straight line, so $a = 180 - 65 =$**115°**. Reason: angles on a straight line add up to 180°.
b. b is in the same position at the other crossing as the 65° angle, so $b = 65^{\circ}$. Reason: corresponding angles are equal.
c. c is vertically opposite the angle that corresponds to a, so $c = 115^{\circ}$. Reasons: corresponding angles are equal and vertically opposite angles are equal.

Answer to Question 5

a. Acute angles are less than 90°, right angles are exactly 90°, obtuse angles are between 90° and 180°, and reflex angles are more than 180°: 35° is **acute**, 90° **right**, 140° **obtuse**, 200° **reflex**.
b. Just under a right angle means a little less than 90°, so a sensible estimate is **85°** (anything from about 70° to 89° is acceptable).
c. The minute hand turns 360° in 60 minutes. 20 minutes is $\frac{20}{60} = \frac{1}{3}$ of an hour, so it turns $\frac{1}{3} \times 360 =$**120°**.
d. The 12 numbers split 360° into gaps of $360 \div 12 = 30^\circ$. At 4:00 the hands point to 12 and 4, four gaps apart: $4 \times 30 =$**120°**.

Answer to Question 6

a. Angles on a line add up to 180°: $3x + 2x + 30 = 180$. Then $5x = 150$ and $x =$**30**. The angles are 90° and 90°.
b. Angles in a triangle add up to 180°: $x + 2x + 3x = 180$, so $6x = 180$ and $x =$**30**. The angles are 30°, 60° and 90°.
c. Angles in a quadrilateral add up to 360°: $x + x + 20 + 2x + 100 = 360$, so $4x + 120 = 360$, $4x = 240$, $x =$**60**. Angles 60°, 80°, 120°, 100° (total 360°).

Answer to Question 7

a. The two base angles are equal and share $180 - 100 = 80^\circ$: $80 \div 2 =$**40°** each.
b. Two base angles of 35° make 70°, so the apex is $180 - 70 =$**110°**.
c. The beam is a line of symmetry, so it cuts the 100° apex in half: **50°** on each side. Check one half: $90 + 40 + 50 = 180$.

Answer to Question 8

a. Angles in a triangle add up to 180°: $180 - 78 - 57 =$**45°**.
b. Its angles 78°, 57°, 45° are the same as the main sail's, so it is the **same shape** (similar). Only the size is different.
c. The base angles are equal and share $180 - 38 = 142^\circ$: $142 \div 2 =$**71°** each.
d. The angles 78°, 57° and 45° are all different and all acute, so the main sail is a **scalene** (acute-angled) triangle.

Answer to Question 9

a. The minute hand turns 360° in 60 minutes, which is 6° per minute: $10 \times 6 =$**60°**.

b. The hour hand goes all the way round in 12 hours: $360 \div 12 =$**30°** per hour.
c. At 3:00 the hands point to 12 and 3, three gaps of 30°: $3 \times 30 =$**90°**, a right angle.
d. The minute hand moves 6° per minute and the hour hand 0.5°, so the gap grows by 5.5° per minute. $180 \div 5.5 \approx 32.7$ minutes, so about **12:33**.

Answer to Question 10

a. Facing north and turning clockwise through 90° (a quarter turn) leaves her facing **east**.
b. East is a bearing of 090°. A further 135° clockwise gives $90 + 135 = 225^\circ$, which is halfway between south and west: **south-west**.
c. A full turn is 360°, so from 225° she needs $360 - 225 =$**135°** clockwise to face north again.
d. 45° anticlockwise from north is halfway between north and west: **north-west**.

Answer to Question 11

a. Corresponding angles are equal, so the angle at the second crossing in the same position is **48°**.
b. Alternate angles (Z shape) are equal, so it is **48°**.
c. Co-interior angles add up to 180°, so it is $180 - 48 =$**132°**.
d. A co-interior angle and the alternate angle next to it lie on a straight line, so they add to 180°. The alternate angle equals the other co-interior angle, so the two co-interior angles also add up to 180°.

Answer to Question 12

a. The angles of a quadrilateral add up to 360°: $360 - 100 - 70 - 70 =$**120°**.
b. Again use 360°: $360 - 90 - 85 - 85 =$**100°**.
c. The line of symmetry through the top and bottom splits the kite into two congruent halves. Each side angle is the mirror image of the other, so the two side angles must be equal.

Answer to Question 13

a. An equilateral triangle has three equal angles sharing 180°: $180 \div 3 =$**60°**.
b. The angles around a point make 360°: $360 \div 120 =$**3** hexagons fit exactly.
c. $360 \div 60 =$**6** triangles fit around a point.
d. Two hexagons give $2 \times 120 = 240^\circ$ and two triangles give $2 \times 60 = 120^\circ$. $240 + 120 = 360^\circ$, a full turn, so they fit with no gaps.

Answer to Question 14

a. The ladder, wall and ground make a triangle with a right angle at the bottom of the wall: $180 - 90 - 68 =$**22°**.
b. 68° is less than the safe minimum of 70°, so the ladder is **not safe**: it is leaning too far out.
c. New angle with the ground: $68 + 9 =$**77°**, which is now safe. With the wall: $90 - 77 =$**13°**.
d. It has a 90° angle and two different acute angles, so it is a **right-angled** scalene triangle.

Answer to Question 15

a. Angle B is 20° more than C, so $B = C + 20$. Angles in a triangle: $50 + (C + 20) + C = 180$, so $2C + 70 = 180$ and $2C = 110$.
b. $C = 110 \div 2 =$**55°** and $B = 55 + 20 =$**75°**. Check: $50 + 75 + 55 = 180$.
c. ACD and angle C lie on a straight line: $180 - 55 =$**125°**.
d. $ACD = 180 - C$, and since $A + B + C = 180$, also $A + B = 180 - C$. So ACD equals A + B. Check: $50 + 75 = 125$.

Answer to Question 16

a. Alternate angles are equal: $3x + 10 = 5x - 30$. Subtract 3x: $10 = 2x - 30$. Add 30: $40 = 2x$, so $x =$**20**.
b. $3 \times 20 + 10 = 70$ and $5 \times 20 - 30 = 70$, so both angles are **70°**.
c. Co-interior angles add up to 180°: $180 - 70 =$**110°**.
d. Corresponding angles are equal, so the transversal makes **70°** with both parallel lines.

Answer to Question 17

a. At the turning point, the way back to the start is on a bearing of $060 + 180 = 240^\circ$. The second leg is on 180°. The angle between them is $240 - 180 =$**60°**.
b. The two legs are both 10 km, so the base angles are equal and share $180 - 60 = 120^\circ$: **60° each**. All angles are 60°, so the triangle is equilateral.
c. The start is above and to the left of the end point. The line back makes 60° with north, measured towards the west, so the bearing is $360 - 60 =$**300°**.

Answer to Question 18

a. Ali subtracted from 360° instead of 180°. Angles on a straight line add up to

180°, so $x = 180 - 130 =$**50°**.

b. Beth's angles add up to $60 + 70 + 80 = 210^\circ$, not 180°. A triangle cannot have these angles.
c. Carl mixed up the facts. Co-interior angles **add up to 180°**; it is alternate and corresponding angles that are equal.
d. Dina's angles total 370°, but a quadrilateral has 360°. With three right angles the fourth must be $360 - 270 =$**90°**.

Answer to Question 19

a. AD and BC are parallel and AB crosses them, so A and B are co-interior angles. Co-interior angles add up to 180°.
b. $2x + 5 + 4x - 5 = 180$. The numbers cancel: $6x = 180$, so $x =$**30**.
c. $A = 2 \times 30 + 5 =$**65°**, $B = 4 \times 30 - 5 =$**115°**, and the opposite angles give **C = 65°** and **D = 115°**.
d. Opposite angles in a parallelogram are equal: C = A = 65° and D = B = 115°. Total: $65 + 115 + 65 + 115 = 360^\circ$, which is correct.

Answer to Question 20

a. Pentagon: $n = 5$, $180 \times (5 - 2) = 180 \times 3 =$**540°**. Hexagon: $180 \times 4 =$**720°**.
b. A regular pentagon has 5 equal angles: $540 \div 5 =$**108°**.
c. Each exterior angle is $180 - 150 = 30^\circ$. Exterior angles add up to 360°, so $360 \div 30 =$**12 sides**.
d. Walking round the polygon you turn through each exterior angle once. When you are back at the start, facing the same way, you have made one full turn, so the exterior angles add up to 360°.