Unit 13 · Lines and Angles

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 35

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Spot the errors

ANSWER U · 4

i. **55°.** The complement makes 90°: $90° - 35° = 55°$. 145° is the supplement.

ii. It is always **acute**: an obtuse angle is more than 90°, so 180° minus it is less than 90°. (For 120°, the supplement is 60°.)

iii. They are **not adjacent**: they overlap. Adjacent angles share a vertex and an arm and lie on **opposite sides** of that arm.

iv. That gives **105**°, halfway between 90° and 120°. For 75° bisect between the **60**° and **90**° arms.

MARKING SCHEME

✓ i. 55°: 145° is the supplement.

✓ ii. Always acute.

✓ iii. Not adjacent: one is inside the other.

✓ iv. Bisect between 60° and 90°.

2 New angles with a compass

ANSWER A · 4

i. Make 150° (bisect between 120° and 180°), then **bisect between the 150° and 180° arms**: $150° + 15° = 165°$.

ii. Make 90°, bisect it for 45°, then **bisect between the 45° and 90° arms**: $(45° + 90°) \div 2 = 67.5°$.

iii. Make 105° (bisect between 90° and 120°), then **bisect the 105°**: 52.5°.

iv. **i: twice** (120°–180° for 150°, then 150°–180°); **ii: three times** (90°, 45°, 67.5°); **iii: three times** (90°, 105°, 52.5°). The 60°, 120° and 180° arms need no bisecting: they are steps of the radius round the arc.

MARKING SCHEME

✓ i. Bisect between 150° and 180°, constructed.

✓ ii. Bisect between 45° and 90°, constructed.

✓ iii. Bisect 105°.

✓ iv. Two, three and three bisections.

3 Angle puzzles

ANSWER A · 4

i. $x = 4(90 - x)$, $5x = 360$, $x = \mathbf{72}°$. Check: its complement is 18°, and $4 \times 18 = 72$ ✓.

ii. $180 - x = 3(90 - x)$, $180 - x = 270 - 3x$, $2x = 90$, $x = \mathbf{45}°$. Check: supplement 135°, complement 45°, $3 \times 45 = 135$ ✓.

iii. $x + (x + 36) = 180$, $2x = 144$: **72° and 108°**.

iv. **No.** An obtuse angle is already more than 90°, so the two would add up to more than 90°.

MARKING SCHEME

✓ i. 72°.

✓ ii. 45°.

✓ iii. 72° and 108°.

✓ iv. No: an obtuse angle alone is more than 90°.

4 Three lines through one point

ANSWER

i. A figure with the six arms in that order, 40° and 75° marked.

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ii. OA, OC, OE and OB are on one side of the straight line AB: $40° + 75° + \angle EOB = 180°$, so $\angle EOB = \mathbf{65}°$. **A · 4**

iii. $\angle BOD = \mathbf{40}°$ (vertically opposite $\angle AOC$), $\angle DOF = \mathbf{75}°$ (vertically opposite $\angle COE$), $\angle FOA = \mathbf{65}°$ (vertically opposite $\angle EOB$).

iv. $40 + 75 + 65 + 40 + 75 + 65 = \mathbf{360}°$: the angles round a point.

MARKING SCHEME

- ✓ i. The figure, arms in order.
- ✓ ii. 65°.
- ✓ iii. 40°, 75°, 65°.
- ✓ iv. 360°, round a point.

5 The clock

ANSWER **A · 4**

i. 12 equal angles make a full turn: $360° \div 12 = \mathbf{30}°$.

ii. 4 steps apart either time: $4 \times 30° = \mathbf{120}°$ both times (the other way round is the reflex angle, 240°).

iii. The minute hand is on 6. From the hour hand (halfway between 2 and 3) to 6 is $3\frac{1}{2}$ steps: $3.5 \times 30° = \mathbf{105}°$.

iv. **9 o'clock**: the hands are 3 steps apart, $3 \times 30° = 90°$.

MARKING SCHEME

- ✓ i. 30°.
- ✓ ii. 120° both times.
- ✓ iii. 105°.
- ✓ iv. 9 o'clock.

6 Four angles round a point

ANSWER **A · 4**

i. $x + 2x + 3x + 4x = 360$, $10x = 360$, $x = \mathbf{36}°$.

ii. **36°, 72°, 108° and 144°**.

iii. **36° and 144°**, and **72° and 108°**: each pair adds up to 180°.

iv. Together they still make $36° + 72° = 108°$, so each is **54°**.

MARKING SCHEME

- ✓ i. 36°.
- ✓ ii. 36°, 72°, 108°, 144°.
- ✓ iii. 36° and 144°; 72° and 108°.
- ✓ iv. 54° each.

7 Judge the measuring

ANSWER **HA · 4**

i. $47 + 68 + 64 = 179°$, not 180°, so AOD **is not a straight line** by his measures (or he measured 1° wrong).

ii. **Yes**: $47 + 68 + 65 = 180°$.

iii. **119° and 117°**: they are vertically opposite, so they must be equal. (Also, each must make 180° with 62°.)

iv. **62°, 118°, 62°, 118°**: $180° - 62° = 118°$. Adding up to 360° is not enough on its own to check the measures.

MARKING SCHEME

- ✓ i. No: 179°.
- ✓ ii. Yes: 180°.
- ✓ iii. 119° and 117°, which must be equal.
- ✓ iv. 62°, 118°, 62°, 118°.

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8 Think: two bisectors

ANSWER HA · 4

i. $\angle AOP = 25°$; $\angle COB = 130°$, so $\angle COQ = 65°$; $\angle POQ = 25° + 65° = \mathbf{90}°$.

ii. $\angle COP = 55°$, $\angle COQ = 35°$: $\mathbf{90}°$ again.

iii. $\angle COP = \frac{x}{2}$ and $\angle COQ = \frac{180 - x}{2} = 90 - \frac{x}{2}$. So $\angle POQ = \frac{x}{2} + 90 - \frac{x}{2} = \mathbf{90}°$, whatever x is: the two halves of a straight angle add up to half of 180°.

iv. The drawing, with the bisectors at a right angle.

MARKING SCHEME

✓ i. 25°, 65°, 90°.

✓ ii. 90°.

✓ iii. $\frac{x}{2} + 90 - \frac{x}{2} = 90$.

✓ iv. The construction, checked.

9 Make your own

ANSWER A · 3

For example:

i. "An angle is 30° more than its supplement." $x = (180 - x) + 30$, $2x = 210$, $x = 105°$.

ii. 60°, 90°, 120° and 90°: $60 + 90 + 120 + 90 = 360$.

iii. 30° and 60° side by side, sharing an arm, making a right angle.

Any correct answers are right.

MARKING SCHEME

✓ i. A puzzle, solved.

✓ ii. Four constructible angles making 360°.

✓ iii. Two adjacent angles making 90°.

See it at Science Playground

Exhibits and plants at the center, Bhaktapur, that go with this unit. Book a class visit at science-playground.com/booking.

- **The Unit Circle** (exhibit): Find 135° and 150° on this circle: 135° lies halfway between 90° and 180°, and 150° halfway between 120° and 180°, just as you construct them.
- **The Compass Rose** (exhibit): The N–S and NE–SW lines cross: N to NE and S to SW are vertically opposite, 45° each, while N to NE and NE to S make 180°.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	4	23	8	**35**

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