Unit 14 · Lines and Angles

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 33

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

1 Clock hands off the hour

ANSWER A · 4

i. In half an hour the hour hand goes half the way from 3 to 4, so it points **halfway between 3 and 4**.

ii. From one hour mark to the next is $360° \div 12 = 30°$, so in half an hour it turns half of that: **15**°.

iii. The hands are 2½ hour marks apart: $30° + 30° + 15° =$ **75**°. It is **acute**, not a right angle.

iv. **No.** The minute hand points at 3, but the hour hand has gone a quarter of the way from 9 to 10. From 3 to 9¼ is 6¼ hour marks, so the hands are $6¼ \times 30° = 187½°$ apart one way and $360° - 187½° =$ **172½**° the other, an **obtuse** angle. The reflex angle is **187½**°.

MARKING SCHEME

- ✓ Halfway between 3 and 4.
- ✓ 15°.
- ✓ 75°, acute.
- ✓ 172½° and 187½° at 9:15.

2 Work backwards

ANSWER A · 3

i. The full turn is $5 + 1 = 6$ equal parts: $360° \div 6 = 60°$. The angles are **60**° and $5 \times 60° =$ **300**°.

ii. Take away the extra 100°: $360° - 100° = 260°$, shared equally, gives 130°. The angles are **130**° and $130° + 100° =$ **230**°.

iii. **Yes.** A reflex angle is between 180° and 360°, so the angle on its other side is between 0° and 180°. It is obtuse when the reflex angle is between 180° and 270°, as in ii.

MARKING SCHEME

- ✓ 60° and 300°.
- ✓ 130° and 230°.
- ✓ Yes, with a reason or an example.

3 Two bisectors on a straight line

ANSWER HA · 4

i. $\angle AOC$ and $\angle BOC$ make a straight angle: $\angle BOC = 180° - 40° =$ **140**°. Half of it: $\angle COD =$ **70**°.

ii. $\angle AOD = 40° + 70° =$ **110**°.

iii. $\angle EOC = 20°$, so $\angle EOD = 20° + 70° =$ **90**°, a **right angle**.

iv. $\angle BOC = 110°$, so $\angle COD = 55°$ and $\angle EOC = 35°$: $\angle EOD = 35° + 55° =$ **90**° again. The two bisectors are always **perpendicular**: they take half of each of the two angles, and half of 180° is 90°.

MARKING SCHEME

- ✓ 140° and 70°.
- ✓ 110°.
- ✓ 90°, a right angle.
- ✓ 90° again: the bisectors are perpendicular.

4 Angles from a compass

ANSWER

i. Draw 30° (bisect 60°), then bisect 30°: **15**°.

ii. Draw 60° and 90° on the same arm. The angle between their arms is 30°; bisect it, and the bisector makes $60° + 15° =$ **75**° with the base. (Or bisect 30° to get 15° and add it to 60°.)

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iii. Draw 90°. The angle between its arm and the base line made longer the other way is 90°; bisect it: 90° + 45° = **135**°. HA · 5

iv. Draw 120°. The angle between its arm and the base line made longer the other way is 60°; bisect it: 120° + 30° = **150**°.

v. The protractor should read **75**°, within a degree or two.

MARKING SCHEME

- ✓ 15°: bisect 30°.
- ✓ 75°: bisect between 60° and 90°.
- ✓ 135°: bisect between 90° and 180°.
- ✓ 150°: bisect between 120° and 180°.
- ✓ A drawn angle that measures about 75°.

5 A health post for two villages

ANSWER A · 4

i. Arcs from K and S with the same radius, more than 4 cm, above and below KS; join their crossings. It cuts KS at its midpoint, 4 cm from each end.

ii. Every point on the perpendicular bisector of KS is the same distance from K as from S, so a place the same distance from both villages lies on it.

iii. HK = HS = **5 cm**, so the health post is **5 km** from each village.

iv. **Two**: one on each side of the road, 3 km from it.

MARKING SCHEME

- ✓ The perpendicular bisector drawn with a compass.
- ✓ Every point on it is equally far from K and S.
- ✓ 5 km from each village.
- ✓ Two places, one on each side of the road.

6 Lines that follow from lines

ANSWER HA · 3

i. $p \parallel q$: both stand at a right angle on the same line r, as the carpenter's shelves do on the upright strip.

ii. $r \perp q$: q runs the same way as p, so r crosses it at the same right angle.

iii. p and r are both perpendicular to q, so $p \parallel r$. s is perpendicular to r, so it is perpendicular to p as well: $p \perp s$.

MARKING SCHEME

- ✓ $p \parallel q$.
- ✓ $r \perp q$.
- ✓ $p \perp s$, through $p \parallel r$.

7 Spot the error

ANSWER U · 3

i. He mixed up the two methods. 180° plus is used with the part **past the straight line**, not with the angle on the other side. With the angle on the other side he must take it **from 360**°.

ii. Reflex $\angle PQR = 360° - 140° = \mathbf{220}°$.

iii. The part past the straight line is 180° − 140° = **40**°, and 180° + 40° = 220° ✓.

MARKING SCHEME

- ✓ 360° minus the other side, not 180° plus.
- ✓ 220°.
- ✓ 40°, and 180° + 40° = 220°.

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8 Make your own

ANSWER A · 3

i. $180° - 75° = \mathbf{105}°$.

ii. $105° = 90° + 15°$. Draw 90° and 120° on the same arm; the angle between their arms is 30°, and its bisector makes $90° + 15° = \mathbf{105}°$ with the base.

iii. For example **60° and 120°** (one step of the radius gives 60°, and the rest of the straight line is 120°), or 30° and 150°, or 15° and 165°. Any pair that adds up to 180°, where one of them can be made by the compass steps or by bisecting them.

MARKING SCHEME

- ✓ 105°.
- ✓ Bisect between 90° and 120°.
- ✓ A pair adding up to 180° that a compass can draw, with how.

9 Think: count the angles

ANSWER HA · 4

i. $\angle EOB = 180° - 30° - 50° - 60° = \mathbf{40}°$.

ii. **9** angles (with $\angle AOB$ itself, a straight angle, left out):

Angle	$\angle AOC$	$\angle AOD$	$\angle AOE$	$\angle COD$	$\angle COE$	$\angle COB$	$\angle DOE$	$\angle DOB$	$\angle EOB$
Size	30°	80°	**140°**	**50°**	**110°**	**150°**	**60°**	**100°**	**40°**

iii. **5 acute** (30°, 80°, 50°, 60°, 40°) and **4 obtuse** (140°, 110°, 150°, 100°).

MARKING SCHEME

- ✓ 40°.
- ✓ 9 angles.
- ✓ Their sizes right.
- ✓ 5 acute and 4 obtuse.

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 Compass Rose** (exhibit): The N–S and E–W lines cross at a right angle, so they are perpendicular. The NE–SW line crosses N–S too: intersecting, but not perpendicular.
- **The Unit Circle** (exhibit): Find 180° on the circle: a straight angle. The angles past it, like 210°, 270° and 330°, are reflex angles, more than 180° and less than 360°.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	3	14	16	**33**

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