10 $\angle CDA = x$ (alternate angles are equal)
$\angle DCA = x$ (angle between the tangent and chord equals the angle in the alternate segment)
In triangle ACD, $\angle CDA = \angle DCA$, therefore AC = AD and the triangle is isosceles.

11 OB is common; OA = OC (radii same circle); $\angle OAB = \angle OCB = 90°$ (angle between radius and tangent is 90°).
Therefore triangles OAB and OCB are congruent (RHS) and AB = BC (corresponding sides).

12 $\angle OSR = 90°$ (angle between radius and tangent is 90°)
$\angle PSO = 90 - 62 = 28°$
$\angle QOS = 140°$ (angles round a point add to 360°)
$\angle SPQ = 70°$ (angle at centre is twice angle at circumference when both subtended by same arc)
$\angle PQS = 360° - 220° - 28° - 70° = 42°$ (angles in a quadrilateral add to 360°)

13 OA = OB (radii same circle); OM is common; AM = MB given M is midpoint of AB;
Triangles OAM and OMB are congruent (SSS)
AMB is a straight line, $\angle AMO = \angle OMB = 180° \div 2 = 90°$

14 Proof that ABD and DCA are congruent using ASA, RHS or SAS

## 16 Unit test

1 Angle OBA = 34° angles on a straight line add to 180°, OA = OB radii of same circle **[1]**
Angle OAB = 34° base angles of isosceles triangle are equal. **[1]**
Angle AOB = 180° – 34° – 34° = 112° angles in a triangle add to 180° **[1]**
(Note: these angles may be annotated on the diagram)
Fully correct reasons **[1]**

2 OA = OB radii same circle
Angle OAB = angle OBA base angles of isosceles triangle are equal.
Angle OAB = (180° – 124°) ÷ 2 = 28° angles in a triangle add to 180° **[1]**
Angle OAT = 90° angle between tangent and radius is 90° **[1]**
Angle BAT = 90° – 28° = 62° **[1]**
(Note: these angles may be annotated on the diagram)
Fully correct reasons **[1]**

3 a 90° **[1]** b $\sqrt{(8^2 - 5^2)} = 6.2\,\text{cm}$ **[1]**

4 Angle BAD = 70° **[1]**
Angle BOD = 140° **[1]**
Opposite angles cyclic quadrilateral add to 180° and angle at centre equals twice angle at circumference when both are subtended by the same arc. **[1]**

5 Angle BAD = 90° the angle in a semicircle is a right angle, **[1]**
Angle ABD =180 – 90° – 19° = 71° (angles in a triangle add to 180°) **[1]**
Angle ACB = 19° angles subtended at the circumference by the same arc are equal **[1]**
Full reasons **[1]**

6 Angle ABC = 90° **[1]** $6y = 90$ **[1]** angle BAC = 75° **[1]**

7 Correct angle calculations **[4]**

Fully correct reasons using language below **[2]** or any one correct reason **[1]**

$OAC = OBC = 90$ (tangent is perpendicular to the radius)

$AOB = 360 - 90 - 90 - 36 = 144$ (angles in a quadrilateral add up to 360°)

$OBA = (180 - 144) \div 2 = 18$ (angles in a triangle add up to 180° and base angles of isosceles triangle are equal)

$CAB = CBA = (180 - 36) \div 2 = 72$

(angles in a triangle add up to 180° and base angles of isosceles triangle are equal)

$OBA = 90 - 72 = 18$ (tangent is perpendicular to the radius)

8 Angle BCD = 53° or angle ABC = 65° **[1]**

Angle ACT = 180° – 62° – 53° = 65° **[1]**

Angle between tangent and chord is equal to the angle in the alternate segment and angles in a triangle add to 180° or angles on a straight line add to 180° **[1]**

9 Angle QRS = angle PQR = a, alternate angles are equal **[1]**

Angle QRS = angle QPR = a, angle between tangent and chord is equal to the angle in the alternate segment. **[1]**

Angle PQR = angle QPR = a **[1]**

No marks unless the reasons are given

10 Gradient radius = $-\frac{3}{4}$ **[1]**

Gradient PT = $\frac{4}{3}$ **[1]**

$3 = \frac{4}{3} \times -4 + c$ **[1]**

$c = \frac{25}{3}$ **[1]**

$y = \frac{4}{3}x + \frac{25}{3}$ or $3y = 4x + 25$ **[1]**

### Sample student answer

Both students worked out the correct value for angle OBT. Student A gave the best answer as they clearly stated the reasons for each part of their calculation. However, Student A's answer could have been improved by showing the calculations so that they didn't lose any method marks if they made an error in calculating.