	Y12 Pure	CH06 6.1,6.2,6.3,6.4,6.5	Coordinate geometry in the (x, y) plane Circles	Lessons 4

Essential Knowledge Milestones	Teaching Points
• be able to find the midpoint of a line segment; • understand and use the equation of a circle; • be able to find points of intersection between a circle and a line; • know and be able to use the properties of chords and tangents. **Assumed Prior Knowledge/ Links / Interleaving** • Equation of a circle • Pythagoras Theorem **Potential Barriers to Access /Misconceptions** • Most errors when completing the square to find the equation of a circle involve the constant term. Students may forget to subtract it or perhaps add it instead. Having found the equation, when giving the coordinates of the centre students must take care to get the signs the right way round as marks are easily lost by getting this wrong. • When substituting into equations to find the intersections with axes, students sometimes substitute for the wrong variable, for example substituting y = 0 when trying to find the intersection with the y-axis. Another error is substituting the entire bracket (x – a) for 0 rather than just x. • When finding the equation of a tangent to a point on the circle, typical errors are: finding the gradient of the radius; finding a line parallel to the radius; and finding a line through the centre of the circle.	• Drawing sketches or annotating given diagrams will help students to understand the question in many cases and so should be encouraged. • Students should be able to find the midpoint given two points from GCSE (9-1) Mathematics. This can be built upon to find the coordinate of a point given the midpoint and one of the end points. The midpoint can be used to find the perpendicular bisector, recapping the work from straight-line graphs. • The equation of the circle $(x-a)^2+(y-b)^2=r^2$ can be derived from Pythagoras' theorem, giving students the opportunity to look at proof. • Students should be able to find the radius and the coordinates of the centre of the circle given the equation of the circle, and vice versa. Students should be familiar with the equations $x^2+y^2+2fx+2gy+c=0$ and $(x-a)^2+(y-b)^2=r^2$. 'Complete the square' method should be used to factorise the equation into the more useful form. Students will need practice within this context to ensure that they are confident with the algebraic manipulation needed, in particular mistakes are often made with the signs and forgetting the constant term. • Circle theorems from GCSE (9-1) Mathematics can be used in questions so a quick recap could be useful and then they should be incorporated into questions. Examples of this include: finding the equation of the circumcircle of a triangle with given vertices; or finding the equation of a tangent using the perpendicular property of tangent and radius. • Simultaneous equations can be used to find the points of intersection between a circle and a straight line. Students can also be asked to show that a line and circle do not intersect, for which the discriminant can be used. Finding intersections with the axes should also be covered.

Questions & Prompts	Opportunities for Reasoning/Problem Solving/Proofs
• Change one number in $(x-4)^2+(y-2)^2=9$ so that the resulting circle passes through all four quadrants • Investigate finding the equation of a circle given 3 points on its circumference. • Find the range of possible values for k for the circle $x^2+y^2-4x+10y=k$ • A circle of radius 5 touches the x axis at (-2, 0) and doesn't go below y = 0, fine the equation of the circle.	• The conditions in which a circle and a line intersect can be investigated, with students justifying which will and will not intersect. • Investigate finding the equation of a circle given 3 points on its circumference. • The conditions in which a circle and a line intersect can be investigated, with students justifying which will and will not intersect. • Three points M, N and K lie on a circle. M (0, -8), N (10, -8) and angle MKN is 90o. What is the equation of the circle? • The point on the circle $x^2+\ y^2+6x+8y=75$ which is closest to the origin is what distance from the origin? • Justify that $x=2y+5$ intersects the circle $x^2+y^2-6x-3y-5=0$ at two points.

Key Mathematical Vocabulary	Equation, bisect, centre, chord, circle, circumcircle, diameter, gradient, intercept, isosceles, linear, midpoint, Pythagoras, radius, segment, semicircle, tangent.		

Personal Development	**Notes**	**Resources**
Pupils are taught that they must show 'resilience' in their approach to completing questions always showing their working to ensure they achieve method marks.		