Question			Answer	Marks	AO	Guidance
11	(a)		$\frac{dy}{dx} = x\cos x$ oe	B1	1.1	
			$x\cos x = 1$	M1	1.1	For *their* $\frac{dy}{dx} = 1$
			$\frac{1}{x} = \cos x$ so $\frac{1}{x} - \cos x = 0$	A1	2.1	Convincing completion to given answer
				[3]		

11	**(b)**		For $f(x)=\frac{1}{x}-\cos x$, $f'(x)=-\frac{1}{x^2}+\sin x$			
			Iteration $x_{n+1}=x_n-\frac{\left(\frac{1}{x_n}-\cos x_n\right)}{\left(-\frac{1}{x_n^2}+\sin x_n\right)}$	**M1** **A1**	**3.1a** **1.1**	Differentiation (for this mark look for a power of x and a term in sin x or cos x with at least one term correct) oe, e.g. $x_{n+1}=x_n-\frac{\left(x_n-x_n^2\cos x_n\right)}{\left(-1+x_n^2\sin x_n\right)}$ **(The subscripts are needed)**
			Suitable starting value	**M1**	**3.1a**	Starting values from 3.6 to 6.1 inclusive work for the given iteration but there may be other values which also give the required root and should be awarded.
			4.9172	**A1**	**1.1**	BC – candidates need not show intermediate iterations If a value outside the expected starting value is used and it converges to 4.9172 then **M1A1** is awarded (no need to check) awrt 4.9172
			Alternative method			
			For $f(x)=x\cos x-1$, $f'(x)=\cos x-x\sin x$			
			Iteration $x_{n+1}=x_n-\frac{\left(x_n\cos x_n-1\right)}{\left(\cos x_n-x_n\sin x_n\right)}$	**M1** **A1**		Differentiation oe, e.g. $x_{n+1}=\frac{\left(1-x_n^2\sin x_n\right)}{\left(\cos x_n-x_n\sin x_n\right)}$
			Suitable starting value	**M1**		Starting values from 3.6 to 6.1 inclusive work for the given iteration but there may be other values which also give the required root.
			4.9172	**A1**		BC – candidates need not show intermediate iterations If a value outside the expected starting value is used and it converges to 4.9172 then **M1A1** is awarded awrt 4.9172
				[4]		

11	**(c)**		The gradient is close to zero so the next iteration is a long way from the root **or** As it is a turning point, the starting value is invalid as you cannot divide by 0 **or** The iteration converges to a different root.	**B1**	**3.2b**	Explanation referring to gradient of curve or to convergence to a different root. Not just that it is close to another root isw after a correct answer
				[1]		

Q11a. The B1 is for differentiating and can be given for seeing x cos x or the unsimplified version sin x + x cos x – sin x.
The M1 is given for x cos x =1 and the final A1 for finishing it off convincingly. If there is no differentiation, then the M1 is not available.

Q11b. There are two methods given.
The first M mark is for attempting to differentiate either 1/x – cos x or x cos x -1.
The first A mark is for setting up the iteration function and it **must** include the subscripts.
The next M mark is for choosing a suitable starting value (accept values between 3.6 and 6.1). They might use x_0 or x_1 or just say 'starting value' – but it will be their first value.
The final A mark is for getting the root 4.9172. The question asked for 4dps. They do not need to show all the working (BC means 'by calculator') to get the A1. If they choose a value outside the range and it gives 4.9172 then give M1 A1. A value outside the range giving the wrong answer will get M0 A0.

Q11c. The comment needs to be more than just 'it is close to another root'.