Question Number	Scheme	Marks
8 (i)	States or uses $\tan x = \dfrac{\sin x}{\cos x} \Rightarrow 5\sin x \times \dfrac{\sin x}{\cos x} + 13 = \cos x$	B1
	$5\sin^2 x + 13\cos x = \cos^2 x \Rightarrow 5\left(1-\cos^2 x\right) + 13\cos x = \cos^2 x$	M1
	$\Rightarrow 6\cos^2 x - 13\cos x - 5 = 0$	A1
	$\Rightarrow (3\cos x + 1)(2\cos x - 5) = 0 \Rightarrow \cos x = -\dfrac{1}{3}$	M1
	$\Rightarrow x = 1.91$	A1
		(5)
(ii) (a)	$20 = 10 + 12\sin(6k+18)^\circ \Rightarrow \sin(6k+18)^\circ = \dfrac{5}{6}$	M1
	$\Rightarrow (6k+18) = 56.4, 123.6$	dM1
	$\Rightarrow k = 6.41, 17.59$	A1, A1
		(4)
(b)	22°C	B1
		(1)
(c)	"6.41"$t + 18 = 90 \Rightarrow t = 11.23$ Time of day = 11:14	M1, A1
		(2)
		(12 marks)

(i)

B1: States or uses $\tan x = \dfrac{\sin x}{\cos x}$ E.g. $5\sin x \times \dfrac{\sin x}{\cos x} + 13 = \cos x$

M1: Attempts to use $\tan x = \dfrac{\sin x}{\cos x}$, $\sin^2 x + \cos^2 x = 1$ and multiply by $\cos x$ to form a quadratic equation in $\cos x$ (allow if there are slips in coefficients but the trig terms must be correct)

A1: Correct simplified quadratic $6\cos^2 x - 13\cos x - 5(=0)$ The "=0" may be implied.

M1: Solves a 3TQ in $\cos x$ leading to at least one value for $\cos x$

A1: awrt $x = 1.91$ (following $\cos x = -\dfrac{1}{3}$) and no other values in the range.

Note: Answers only with no working score no marks. From $6\cos^2 x - 13\cos x - 5(=0)$ to 1.91 directly, score final M0A0.

(ii) (a)

M1: Attempts to use the given information and proceeds to $\sin(6k+18)^\circ = c$, or may be implied by $A\sin(6k+18)^\circ = B \rightarrow 6k+18 = \arcsin\dfrac{B}{A}$ (evaluated) (which scores M1dM1)

dM1: Takes arcsin leading to a value for $6k+18$. Accept radian values seen for this mark. (0.985, 2.16). Allow awrt 2 s.f. answers for evidence.

A1: One value for k: 6.41 or 17.59 Must be in degrees.

SC Allow for 6.4 **and** 17.6 both given if no more accurate answers are stated.

A1: awrt $k = 6.41, 17.59$ and no other values

Note answers only scores no marks. – the requirements of the M marks must be seen to be able to score them.

(ii)(b)

B1: cao 22°C Condone just 22.

(ii)(c)

M1: Sets their "6.41"$t + 18 = 90 \Rightarrow t = ...$ May be implied by 11.23.

Note "6.41"$t + 18 = \dfrac{\pi}{2}$ is M0.

A1: cao Time of day = 11:14 o.e. (e.g. 11h 14m is acceptable).

Question Number	Scheme	Marks
9.(a)	$y = 2x^{\frac{3}{2}}(4-x) = 8x^{\frac{3}{2}} - 2x^{\frac{5}{2}}$	
	$\frac{dy}{dx} = 12x^{\frac{1}{2}} - 5x^{\frac{3}{2}}$	M1, A1
	Stationary point $12x^{\frac{1}{2}} - 5x^{\frac{3}{2}} = 0 \Rightarrow x = \frac{12}{5}$	dM1, A1
		(4)
(b)	$\int 8x^{\frac{3}{2}} - 2x^{\frac{5}{2}} dx = \frac{16}{5}x^{\frac{5}{2}} - \frac{4}{7}x^{\frac{7}{2}}$	M1, A1
	$\frac{16}{5}k^{\frac{5}{2}} - \frac{4}{7}k^{\frac{7}{2}} = 0 \Rightarrow k = \frac{16\times 7}{4\times 5} = \frac{28}{5}$	dM1, A1
		(4) **(8 marks)**

(a)

M1: Complete attempt to differentiate.
Writes as a sum of two terms and reduces the power of at least one term by 1
Alternatively, by the product rule look for $Ax^{\frac{1}{2}}(4-x) - Bx^{\frac{3}{2}}$

A1: $\left(\frac{dy}{dx} =\right) 12x^{\frac{1}{2}} - 5x^{\frac{3}{2}}$ or $3x^{\frac{1}{2}}(4-x) - 2x^{\frac{3}{2}}$. May be left unsimplified

dM1: Sets $\frac{dy}{dx} = 0$ and attempts to solve to find a non-zero value for x. Do not be concerned about the method of solving for this mark.

A1cso: $x = \frac{12}{5}$ from correct work. Ignore reference to $x = 0$. Watch for incorrect methods of solving, such as $\left(12x^{\frac{1}{2}} - 5x^{\frac{3}{2}}\right)^2 = 0 \Rightarrow 144x - 25x^3 = 0 \Rightarrow x = \frac{12}{5}$, which score A0.

(b)

M1: Complete attempt to integrate. Writes as a sum of two terms and increases the power of at least one term by 1. For attempts at integrating by parts they must proceed through the second integration to score the mark.

A1: $\frac{16}{5}x^{\frac{5}{2}} - \frac{4}{7}x^{\frac{7}{2}}$ which may be unsimplified

dM1: Substitutes $x = k$ in their $\frac{16}{5}x^{\frac{5}{2}} - \frac{4}{7}x^{\frac{7}{2}} = 0$ and solves. Alternatively, applies limits 0 and 4 to find the area $R_1 \left(= \frac{1024}{35}\right)$ and sets equal to the negative of the expression from limits 4 to k (or reverses the limits and sets equal) and proceeds to reach a value for k.

A1: $k = \frac{28}{5}$ (ignore references to $k = 0$) Accept as decimal 5.6.