Mark Scheme 4724
January 2006

Q	Part	Answer	Mark	Total	Guidance
1		Attempt to factorise numerator and denominator	M1		
		num = $xx(x-3)$ or denom = $(x-3)(x+3)$	A1		Not num = $x(x^2-3x)$
		Final answer = $\frac{x^2}{x+3}$ [Not $\frac{xx}{x+3}$]	A1	3	Do not ignore further cancellation.
2		$\frac{d}{dx}(\sin y) = \cos y.\frac{dy}{dx}$	B1		
		$\frac{d}{dx}(xy) = x\frac{dy}{dx} + y$ s.o.i.	B1		[SR: If xy taken to LHS, accept $-x\frac{dy}{dx} + y$ as s.o.i.]
		$\cos y.\frac{dy}{dx} = x\frac{dy}{dx} + y + 2x$ AEF	B1		
		[If written as $\frac{dy}{dx} = \cos y\frac{dy}{dx} = x\frac{dy}{dx} + y + 2x$, accept for prev B1 but not for following marks if the $\frac{dy}{dx}$ is used]			
		$f(x,y)\frac{dy}{dx} = g(x,y)$	M1		Regrouping provided > one $\frac{dy}{dx}$ term
		$\frac{y+2x}{\cos y - x}$ or $-\frac{y+2x}{x-\cos y}$ or $\frac{-2x-y}{x-\cos y}$	A1	5	ISW Answer could imply M1
3	(i)	Quotient = $3x + ...$	B1		For correct leading term in quotient
		For evidence of correct division process	M1		Or for cubic $\equiv (x^2-2x+5)(gx+h)\ (+...)$
		$3x+4$	A1		For correct quotient
		$-6x-13$	A1	4	For correct remainder ISW
	(ii)	$a = 7$	B1√		Follow through If rem in (i) is $Px+Q$,
		$b = 20$	B1√	2	then B1√ for $a = 1-P$ and B1√ for $b = 7-Q$
		[SR: If B0+B0, award B1√ for $a = 1+P$ AND $b = 7+Q$; also SR B1 for $a = 20, b = 7$]			
4	(i)	Parts using correct split of $u = x, \frac{dv}{dx} = \sec^2 x$	M1		1st stage result of form $f(x) +/- \int g(x)\,dx$
		$x\tan x - \int \tan x\,dx$	A1		Correct 1st stage
		$\int \tan x\,dx = -\ln\cos x$ or $\ln\sec x$	B1		
		$x\tan x + \ln\cos x + c$ or $x\tan x - \ln\sec x + c$	A1	4	
	(ii)	$\tan^2 x = +/-\sec^2 x +/- 1$	M1		or $\sec^2 x = +/-1 +/- \tan^2 x$
		$\int x\sec^2 x\,dx - \int x\,dx$ s.o.i.	A1		Correct 1st stage
		$x\tan x + \ln\cos x - \frac{1}{2}x^2 + c$	A1√	3	f.t. their answer to part $(\text{i}) - \frac{1}{2}x^2$

5	(i)	$\frac{dy}{dx}=\frac{dy}{dt}/\frac{dx}{dt}$	M1		Used, not just quoted
		$\frac{1}{t}$ or t^{-1}	A1	2	Not $\frac{2}{2t}$ as final answer
		SR: M1 for Cart conv, finding $\frac{dy}{dx}$ & ans involv t + A1			M1 is attempt only, accuracy not involved
	(ii)	Finding equation of tangent (using p or t)	M1		
		$py=x+p^2$	A1	2	**AG**; p essential; at least 1 line inter working
	(iii)	$(25,-10)\Rightarrow p=-5$ or $-5y=x+25$ seen	B1		$5y=x+25$ seen $\Rightarrow$ B0
		Substitution of their values of p into given tgt eqn	M1		Producing 2 equations
		Solving the 2 equations simultaneously	M1		
		$(-15,-2)$ $x=-15, y=-2$	A1	4	Common wrong ans $(15,8)\Rightarrow$ B0, M2, A0
6	(i)	Attempt to connect $dx, d\theta$	M1		But not $dx=d\theta$
		$dx=2\sin\theta\cos\theta\, d\theta$	A1		AEF
		$\sqrt{\frac{x}{1-x}}=\frac{\sin\theta}{\cos\theta}$	B1		Ignore any references to $\pm$.
		Reduction to $\int 2\sin^2\theta\, d\theta$	A1	4	**AG** WWW
	(ii)	$\sin^2\theta=k(+/-1+/-\cos 2\theta)$	M1		Attempt to change $(2)\sin^2\theta$ into $f(\cos 2\theta)$
		$2\sin^2\theta=1-\cos 2\theta$	A1		Correct attempt
		$\int\cos 2\theta\, d\theta=\frac{1}{2}\sin 2\theta$	B1		Seen anywhere in this part
		Attempting to change limits	M1		<u>Or</u> Attempting to resubstitute; Accept degrees
		$\frac{1}{2}\pi$	A1	5	
		<u>Alternatively</u> Parts once & use			
		$\cos^2\theta=1-\sin^2\theta$	(M2)		Instead of the M1 A1 B1
		$\frac{1}{2}(\theta-\sin\theta\cos\theta)$	(A1)		Then the final M1 A1 for use of limits
7	(i)	$A=3$	B1		For correct value stated
		$C=1$	B1		For correct value stated
		$11+8x\equiv A(1+x)^2+B(2-x)(1+x)+C(2-x)$	M1		AEF; any suitable identity
		e.g. $A-B=0, 2A+B-C=8, A+2B+2C=11$	A1		For any correct (f.t.) equation involving B
		$B=3$	A1	5	
	(ii)	$\left(1-\frac{x}{2}\right)^{-1}=1+\frac{x}{2}+\frac{x^2}{4}+\ldots$	B1		s.o.i.
		$(1+x)^{-1}=1-x+x^2-\ldots$	B1		s.o.i.
		$(1+x)^{-2}=1-2x \quad +3x^2-\ldots$	B1,B1		s.o.i.
		Expansion = $\frac{11}{2}-\frac{17}{4}x+\frac{51}{8}x^2+\ldots$	B1	5	CAO. No f.t. for wrong A and/or B and/or C

SR(1) If partial fractions not used but product of but $(11+8x)(2-x)^{-1}(1+x)^{-2}$ attempted, then

B1 for $\left(1-\frac{x}{2}\right)^{-1}=1+\frac{x}{2}+\frac{x^2}{4}+\ldots$

B1,B1 for $(1+x)^{-2}=1-2x+\ldots+3x^2+\ldots$

B1,B1 for $\frac{11}{2}-\frac{17}{4}x+\ldots+\frac{51}{8}x^2+\ldots$

SR(2) If partial fractions not used denominator multiplied out, then

B1 for denom = $2+3x(+0x^2)+\ldots$

B1 for $\left(1+\frac{3x}{2}\right)^{-1}=1-\frac{3x}{2}+\frac{9x^2}{4}+\ldots$

B1,B1,B1 for $\frac{11}{2}\ldots-\frac{17}{4}x\ldots+\frac{51}{8}x^2+\ldots$

N.B. In both SR, if final expansion given B0, -------------------allow SR B1 for $22-17x+51/2\,x^2$

8	**(i)**	$\int(y-3)\,dy=\int(2-x)\,dx$ or equiv	M1		For separation & integration of both sides
		$\frac{1}{2}y^2-3y=2x-\frac{1}{2}x^2$	A1		or $\frac{1}{2}(y-3)^2=-\frac{1}{2}(x-2)^2$
		For an arbitrary const on one/both sides	*B1		} (or + M2 for equiv statement using limits)
		Substituting $(x,y)=(5,4)$ or (4,5) & finding 'c'	dep*M1		}
		$\frac{1}{2}y^2-3y=-\frac{1}{2}x^2+2x-\frac{3}{2}$ AEF ISW	A1	**5**	or $\frac{1}{2}(y-3)^2=-\frac{1}{2}(x-2)^2+5$ AEF
	(ii)	Attempt to clear fracts (if nec) & compl square	M1		
		$a=2, b=3, k=10$	A2	**3**	For all 3; SR: A1 for 1 or 2 correct
	(iii)	Circle clearly indicated in a sketch	B1		
		Centre $(2,3)$ or their (a,b)	B1√		
		Radius $\sqrt{10}$ or their $\sqrt{k}$	B1√	**3**	√ provided $k>0$

9	**(i)**	Using $\begin{pmatrix}-8\\1\\-2\end{pmatrix}$ and $\begin{pmatrix}-9\\2\\-5\end{pmatrix}$ as the relevant vectors	M1		i.e. correct direction vectors
		Using $\cos\theta=\frac{\underline{a}.\underline{b}}{\lvert\underline{a}\rvert\lvert\underline{b}\rvert}$ AEF for any 2 vectors	M1		Accept $\cos\theta=\left\lvert\frac{\underline{a}.\underline{b}}{\lvert\underline{a}\rvert\lvert\underline{b}\rvert}\right\rvert$
		Method for scalar product of any 2 vectors	M1		
		Method for finding magnitude of any vector	M1		
		15° (15.38…), 0.268 rad	A1	**5**	
	(ii)	Produce (at least) 2 of the 3 eqns in t and s	M1		e.g. $4-8t=-2-9s$, $-6-2t=-2-5s$
		Solve the (x) and (z) equations	M1		
		$t=3$ or $s=2$	A1		for first value found
		$s=2$ or $t=3$ f.t.	A1√		for second value found
		Substituting their (t,s) into (y) equation	M1		
		$a=1$	A1		
		Substituting their t into l_1 or their (s,a)			

into l_2	M1		
$\begin{pmatrix}-20\\5\\-12\end{pmatrix}$	A1	**8**	Any format but not $\begin{pmatrix}\\\\\end{pmatrix}+\begin{pmatrix}\\\\\end{pmatrix}$