1	(Quotient =) $x^2 + 2x + 2$	B1	For correct leading term x^2 in quotient
		M1	For evidence of division/identity process
		A1	For correct quotient
	(Remainder =) $0x - 3$	A1 **4**	For correct remainder. The '0x' need not be written but must be clearly derived. **4**
	Allow without working		
2		M1	For attempt at parts going correct way ($u = x$, $dv = \cos x$ and $f(x)$ +/– $\int g(x)\,(dx)$
	$x \sin x - \int \sin x\, dx$	A1	For both terms correct
	$(= x \sin x + \cos x)$	B1	Indic anywhere that $\int \sin x\, dx = -\cos x$
		M1	For correct method of limits
	Answer = ½ π – 1	A1 **5**	For correct exact answer ISW **5**
3	(i)	M1	For (either point) + (diff betw vectors)
	$\mathbf{r} = (2\mathbf{i}-3\mathbf{j}+\mathbf{k}$ or $-\mathbf{i}-2\mathbf{j}-4\mathbf{k}) + t(3\mathbf{i}-\mathbf{j}+5\mathbf{k})$	A1 **2**	Completely correct including **r** =. AEF
	(ii) $L(2)$ $(\mathbf{r}) = 3\mathbf{i}+2\mathbf{j}-9\mathbf{k}+s(4\mathbf{i}-4\mathbf{j}+5\mathbf{k})$	M1	For point + (s or t) direction vector
	L(1)&L(2) must be of form $\mathbf{r} = \mathbf{a} + t\mathbf{b}$		
	$2+3t=3+4s$, $-3-t=2-4s$, $1+5t=-9+5s$ or suitable equivalences	M1	For 2/3 eqns with 2 different parameters
	(t,s) = (+/-3,2) or (–/+1,1) or (–/+9,-7) or (+/–4,2) or (0,1) or (–/+8,-7)	M1	For solving any relevant pair of eqns
		A1	For both parameters correct
	Basic check other eqn & interp √	B1 **5**	**7**
4	(i) $dx = \sec^2\theta\, d\theta$ AEF	M1	Attempt to connect $dx, d\theta$ (not $dx = d\theta$)
		A1	For $dx = \sec^2\theta\, d\theta$ or equiv correctly used
	Indefinite integral = $\int \cos^2\theta\, d\theta$	A1 **3**	
	(ii) $= k\int$ +/– 1 +/– cos 2θ dθ	M1	With at least one intermed step **AG**
	½[θ + ½ sin 2θ]	A1	"Satis" attempt to change to double angle
	Limits = ¼π(accept 45) and 0	M1	Correct attempt + correct integration
	(π + 2)/8 AEF	A1 **4**	New limits for θ or resubstituting
			Ignore decimals after correct answer **7**
			Single 'parts' + $\sin^2\theta = 1 - \cos^2\theta$ acceptable
5	(i) **OD**=**OA**+**AD** or **OB**+**BC**+**CD** AEF	M1	Connect **OD** & 2/3/4 vectors in their diag
	AD = **BC** or **CD** = **BA**	A1	Or similar ,from their diag
	$(\mathbf{a} + \mathbf{c} - \mathbf{b}) = 2\mathbf{j} + \mathbf{k}$	A1 **3**	[i e if diag mislabelled, M1A1A0 possible]
	(ii) **AB**.**CB** = |**AB**||**CB**| cos θ	M1	
	Scalar product of any 2 vectors	M1	Or **AB**,**BC** i e scalar prod for correct pair
	Magnitude of any vector	M1	
	94°(94.386...) or 1.65 (1.647 ..)	A1 **4**	2 + 3 – 6 = – 1 is expected
			√19 or 3 expected
			Accept 86°(85.614) or 1.49(424..) **7**
6	(i) For $d/dx\,(y^2) = 2y\, dy/dx$	B1	
	Using d(uv) = u dv + v du	M1	
	$2xy\, dy/dx + y^2 = 2 + 3\, dy/dx$	A1	
		M1	Solving an equation,with at least 2 dy/dx terms, for dy/dx; dy/dx on one side, non dy/dx on other.
	$dy/dx = (2 - y^2)/(2xy - 3)$	A1 **5**	**AG**

	(ii) Stating/using $2xy - 3 = 0$	B1	No use of $2 - y^2$ in this part.
	Attempt to eliminate x or y	M1	Between $2xy - 3 = 0$ & eqn of curve
	$8x^2 = -9$ or $y^2 = -2$	A1 **3**	Together with suitable finish **8**
7	(i) $dy/dx = (dy/dt) / (dx/dt)$	M1	(S.R.Award M1 for attempt to change to cartesian eqn & differentiate + A1 for dy/dx or dx/dy in terms of x or y)
	$= (-1/t^2) / 2t$ as unsimplified expression	A1	
	$= -1 / 2t^3$ as simplified expression	A1 **3**	Not $1/-2t^3$. Not in terms of x &/or y.
		B1	
	(ii) (4,–1/2) ⇒ $t = -2$ only	M1	Using $t = -2$ or 2
	Satis attempt to find equation of tgt	A1 **3**	**AG**
	$x - 16y = 12$ only		
	(iii)	M1	For substituting $(t^2, 1/t)$ into tgt eqn or solving simult tgt & their cartes eqns
		A1	For simplified equiv non-fract cubic
	$t^3 - 12t - 16 = 0$ or $16y^3 + 12y^2 - 1 = 0$		
	or $x^3 - 24x^2 + 144x - 256 = 0$	B2 **4**	S.R. Award B1 for "4 or –2".
	$t = 4$ (only) ISW giving cartesian coords		S.R. If B0, award M1 for clear indic of method of soln of correct eqn. **10**
8	(i) $3x+4 \equiv A(2+x)^2 + B(2+x)(1+x) + C(1+x)$	M1	Accept ≡ or =
	$A = 1$	A/B1	If identity used, award 'A' mark, if
	$C = 2$	A/B1	cover-up rule used, award 'B' mark
	$A+B = 0$ or $4A+3B+C = 3$ or $4A+2B+C = 4$	A1	Any correct eqn for B from identity
	$B = -1$	A1 **5**	
		B1	Expansion of $(1 + x)^{-1}$
	(ii) $1 - x + x^2$	B1	Expansion of $(1 + ½x)^{-1}$
	$1 - ½x + ¼x^2$	B1	First 2 terms of $(1 + ½x)^{-2}$
	$1 - x$	B1	Third term of $(1 + ½x)^{-2}$
	$+ ¾x^2$	B1 **5**	Complete correct expansion
	$1 - 5/4\,x + 5/4\,x^2$		If partial fractions not used
			Award B1 for expansion of $(1+x)^{-1}$
			B1+B1 for expansion of $(1 + ½x)^{-2}$, and B1 for 1–5/4x... & B1 for...+5/4x²
			Or if denom expanded to give $a+bx+cx^2$ with a=4,b=8,c=5,award B1
			Expansion of $[1+(b/a)x+(c/a)x^2]^{-1} =$
			$1 - (b/a)x + \ldots\ (-c/a + b^2/a^2)x^2$ B1+B1
			Final ans = $(1 - 5/4x \ldots + 5/4x^2)$B1+B1
		B1 **1**	Other inequalities to be discarded. **11**
	(iii) $-1 < x < 1$ AEF		
9	k = const of proportionality	B2 **2**	All 4 items (first two may be linked)
	– = falling, $d\theta/dt$ = rate of change		S.R. Award B1 for any 2 items
	θ – 20 = diff betw obj & surround temp		
	(ii) $\int 1/(\theta - 20)\, d\theta = -k \int dt$	M1	For separating variables
	$\ln(\theta - 20) = -kt + c$	A1A1	For integ each side (c not essential)
	Subst $(\theta, t) = (100,0)$ or $(68,5)$	M1	Dep on 'c' being involved
		A1	[or M2 for limits (100,0) (68,5) + A1 for

	$c = \ln 80$ $k = 1/5 \ln 5/3$ $\theta = 20 + 80e^{\frac{1}{5}\ln(\frac{5}{3})t}$ (iii) Substitute $\theta = 68 - 32$ $t = 15.75$ Extra time = 10.75, √their 15.75 – 5	A1 M1 A1 **8** M1 A1 B1 **3**	k] *AG* Subst into AEF of given eqn & solve Accept 15.7 or 15.8 f.t. only if θ = their (68 – 32) or 32 **13**

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