Mark Scheme 4724
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1	(Quotient =) $x^2 + 2x + 2$ (Remainder =) $0x - 3$ Allow without working	B1 M1 A1 A1 **4**	For correct leading term x^2 in quotient For evidence of division/identity process For correct quotient For correct remainder. The '$0x$' need not be written but must be clearly derived. **4**
2	$x \sin x - \int \sin x \, dx$ $(= x \sin x + \cos x)$ Answer = ½ π – 1	M1 A1 B1 M1 A1 **5**	For attempt at parts going correct way (u = x, dv = cos x and f(x) +/–∫g(x) (dx) For both terms correct Indic anywhere that $\int \sin x \, dx = -\cos x$ For correct method of limits For correct exact answer ISW **5**
3	(i) **r** = (2**i**-3**j**+**k** or –**i**–2**j**–4**k**) + t(3**i**–**j**+5**k**) (ii) *L*(2) (**r**) = 3**i**+2**j**–9**k**+s(4**i** – 4**j** + 5**k**) *L(1)&L(2)* must be of form **r** = **a** + t**b** 2+3t=3+4s, –3–t=2–4s,1+5t= – 9+5s or suitable equivalences (t,s) = (+/-3,2) or (–/+1,1) or (–/+9,-7) or (+/–4,2) or (0,1) or (–/+8,-7) Basic check other eqn & interp √	M1 A1 **2** M1 M1 M1 A1 B1 **5**	For (either point) + t(diff betw vectors) Completely correct including **r** =. AEF For point + (s or t) direction vector For 2/3 eqns with 2 different parameters For solving any relevant pair of eqns For both parameters correct **7**
4	(i) $dx = \sec^2\theta \, d\theta$ AEF Indefinite integral = $\int \cos^2\theta \, d\theta$ (ii) = k∫ +/– 1 +/– cos 2θ dθ ½[θ + ½ sin 2θ] Limits = ¼π(accept 45) and 0 (π + 2)/8 AEF	M1 A1 A1 **3** M1 A1 M1 A1 **4**	Attempt to connect dx,dθ (not dx = dθ) For $dx = \sec^2\theta \, d\theta$ or equiv correctly used With at least one intermed step **AG** "Satis" attempt to change to double angle Correct attempt + correct integration 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 **AD** = **BC** or **CD** = **BA** (**a** + **c** – **b**) = 2**j** + **k** (ii**) AB.CB** = |**AB**||**CB**| cos θ Scalar product of <u>any</u> 2 vectors Magnitude of <u>any</u> vector 94°(94.386…) or 1.65 (1.647…)	M1 A1 A1 **3** M1 M1 M1 A1 **4**	Connect **OD** & 2/3/4 vectors in their diag Or similar ,from their diag [i.e.if diag mislabelled, M1A1A0 possible] Or **AB.BC** i.e.scalar prod for correct pair $2 + 3 - 6 = -1$ is expected √19 or 3 expected Accept 86°(85.614…) or 1.49(424..) **7**
6	(i) For $d/dx\,(y^2) = 2y \, dy/dx$ Using d(uv) = u dv + v du $2xy \, dy/dx + y^2 = 2 + 3 \, dy/dx$ $dy/dx = (2 - y^2)/(2xy - 3)$	B1 M1 A1 M1 A1 **5**	Solving an equation,with at least 2 dy/dx terms, for dy/dx; dy/dx on one side, non dy/dx on other. **AG**

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

	c = ln 80 k = 1/5 ln 5/3 $\theta = 20 + 80e^{-\left(\frac{1}{5}\ln\frac{5}{3}\right)t}$ (iii) Substitute θ = 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**