

Mark Scheme 4724  
June 2005

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 = $\frac{1}{2} \pi - 1$	M1 A1 B1 M1 A1 5	For attempt at parts going correct way ( $u = x$ , $dv = \cos x$ and $f(x) +/ - \int g(x) \, dx$ ) 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) $\mathbf{r} = (2\mathbf{i} - 3\mathbf{j} + \mathbf{k}$ or $-\mathbf{i} - 2\mathbf{j} - 4\mathbf{k}) + t(3\mathbf{i} - \mathbf{j} + 5\mathbf{k})$ (ii) $L(2)$ ( $\mathbf{r} = 3\mathbf{i} + 2\mathbf{j} - 9\mathbf{k} + s(4\mathbf{i} - 4\mathbf{j} + 5\mathbf{k})$ ) $L(1)$ & $L(2)$ 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 ( $t, s$ ) = $(+/-3, 2)$ or $(-/+1, 1)$ or $(-/+9, -7)$ or $(+/-4, 2)$ or $(0, 1)$ or $(-/+8, -7)$ Basic check other eqn & interp $\checkmark$	M1 A1 2 M1  M1 M1 A1 B1 5	For (either point) + $t$ (diff betw vectors) Completely correct including $\mathbf{r} =$ . 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) = $k \int +/ - 1 +/ - \cos 2\theta \, d\theta$ $\frac{1}{2}[\theta + \frac{1}{2} \sin 2\theta]$ Limits = $\frac{1}{4}\pi$ (accept 45) and 0 $(\pi + 2)/8$ AEF	M1 A1 A1 3 M1 A1 M1 A1 4	Attempt to connect $dx, d\theta$ (not $dx = d\theta$ ) 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 $\theta$ or resubstituting Ignore decimals after correct answer 7 Single 'parts' + $\sin^2 \theta = 1 - \cos^2 \theta$ acceptable
5	(i) $\mathbf{OD} = \mathbf{OA} + \mathbf{AD}$ or $\mathbf{OB} + \mathbf{BC} + \mathbf{CD}$ AEF $\mathbf{AD} = \mathbf{BC}$ or $\mathbf{CD} = \mathbf{BA}$ $(\mathbf{a} + \mathbf{c} - \mathbf{b}) = 2\mathbf{j} + \mathbf{k}$  (ii) $\mathbf{AB} \cdot \mathbf{CB} =  \mathbf{AB}   \mathbf{CB}  \cos \theta$ Scalar product of <u>any</u> 2 vectors Magnitude of <u>any</u> vector $94^\circ (94.386\dots)$ or $1.65 (1.647\dots)$	M1 A1 A1 3  M1 M1 M1 A1 4	Connect $\mathbf{OD}$ & 2/3/4 vectors in their diag Or similar, from their diag [i.e. if diag mislabelled, M1A1A0 possible]  Or $\mathbf{AB} \cdot \mathbf{CB}$ i.e. scalar prod for correct pair $2 + 3 - 6 = -1$ is expected $\sqrt{19}$ or 3 expected Accept $86^\circ (85.614\dots)$ or $1.49 (424\dots)$ 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	<b>8</b>
7	(i) $dy/dx = (dy/dt) / (dx/dt)$ $= (-1/t^2) / 2t$ as unsimplified expression  $= -1 / 2t^3$ as simplified expression  (ii) $(4, -1/2) \rightarrow t = -2$ <u>only</u> Satis attempt to find equation of tgt $x - 16y = 12$ <u>only</u>  (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 $2$ <b>AG</b>  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. <b>10</b>	
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) $1 - x + x^2$ $1 - \frac{1}{2}x + \frac{1}{4}x^2$ $1 - x$ $+ \frac{3}{4}x^2$ $1 - \frac{5}{4}x + \frac{5}{4}x^2$  (iii) $-1 < x < 1$ AEF	M1 A/B1 A/B1 A1 A1 5  B1 B1 B1 B1 B1 5  B1 1	Accept $\equiv$ or = If identity used, award 'A' mark, if cover-up rule used, award 'B' mark. <u>Any</u> 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  <u>If partial fractions not used</u> 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 $...+5/4x^2$ <u>Or</u> if denom expanded to give $a+bx+cx^2$ with $a=4, b=8, c=5$ , award B1 Expansion of $[1+(b/a)x+(c/a)x^2]^{-1} = 1 - (b/a)x + ... (-c/a + b^2/a^2)x^2$ B1+B1 Final ans = $(1 - 5/4x... + 5/4x^2)$ B1+B1  Other inequalities to be discarded. <b>11</b>	
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 $\theta = 68 - 32$ $t = 15.75$ Extra time = 10.75, $\sqrt{\text{their } 15.75 - 5}$	A1 M1 A1 <b>8</b>  M1 A1 B1 <b>3</b>	k ]   AG  Subst into AEF of given eqn & solve Accept 15.7 or 15.8 f.t. only if $\theta = \text{their } (68 - 32)$ or 32 <b>13</b>
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