A2 Assignment kappa Cover Sheet **Name:**

Question		Done	BP	Ready	Topic	Comment
Drill	Aa				C4 Integration	$\frac{2}{3}\sin\frac{3}{2}x+c$
	Ab				C4 Integration	$\tan x+c$
	Ac				C4 Integration	$-\frac{1}{3}\cot 3x+c$
	Ba				C3 Modulus solves	$\frac{1}{6}$ and $\frac{7}{4}$
	Bb				C3 Modulus solves	–3, 2
	Bc				C3 Modulus solves	$-\frac{5}{8},\ \frac{5}{2}$
	Bd				C3 Modulus solves	$\frac{1}{4}$, 3
	Be				C3 Modulus solves	$\pm 1, \pm 4$
	Ca				C4 Binomial Expansion (simple)	$\frac{1}{2}-\frac{1}{4}x+\frac{1}{8}x^2-\frac{1}{16}x^3+\cdots, \lvert x\rvert<2$
	Cb				C4 Binomial Expansion (simple)	$\frac{1}{27}+\frac{1}{27}x+\frac{2}{81}x^2+\frac{10}{729}x^3+\cdots \lvert x\rvert<3$
	Cc				C4 Binomial Expansion (simple)	$2-2x-2x^2-\frac{10}{3}x^3+\cdots, \lvert x\rvert<\frac{1}{3}$
	Cd				C4 Binomial Expansion (simple)	$\frac{1}{2}-\frac{3}{8}x+\frac{27}{64}x^2-\frac{135}{256}x^3+\cdots, \lvert x\rvert<\frac{2}{3}$
	Da				C4 Partial Fractions	$\frac{1}{x+2}+\frac{1}{x+3}$
	Db				C4 Partial Fractions	$\frac{4}{x}-\frac{2}{x^2}+\frac{3}{x+1}$
	Dc				C4 Partial Fractions	$\frac{5}{x+2}-\frac{4}{x+3}$
Mock Exam	MEAi				Trig	$\frac{2p}{1+p^2}$
	MEAii				Trig	$\frac{1-p^2}{1+p^2}$
	MEAiii				Trig	$\frac{2p}{1-p^2}$
	MEB				Trig	R.H.S. $=\frac{1-\tan^2\left(\frac{\theta}{2}\right)}{1+\tan^2\left(\frac{\theta}{2}\right)}=\frac{1-\tan^2\left(\frac{\theta}{2}\right)}{\sec^2\left(\frac{\theta}{2}\right)}$ $=\cos^2\left(\frac{\theta}{2}\right)\left\{1-\tan^2\left(\frac{\theta}{2}\right)\right\}$ $=\cos^2\left(\frac{\theta}{2}\right)-\sin^2\left(\frac{\theta}{2}\right)=\cos\theta=$ L.H.S

	MEC				Trig	R.H.S $= \frac{2\tan\left(\frac{\theta}{2}\right)}{\sec^2\left(\frac{\theta}{2}\right)} = 2\frac{\sin\left(\frac{\theta}{2}\right)}{\cos\left(\frac{\theta}{2}\right)} \times \frac{\cos^2\left(\frac{\theta}{2}\right)}{1}$ $= 2\sin\left(\frac{\theta}{2}\right)\cos\left(\frac{\theta}{2}\right) = \sin\theta$
Current work	1a				M2 Projectiles – find height given horizontal dist	4.4m
	1b				M2 Projectiles – find speed after 2 sec	48 ms^{-1}
	1c				M2 Projectiles – times when moving $\tan^{-1}(1/4)$	0.20s and 2.7s
	2a				M2 Projectiles – furthest distance	35m
	2b				M2 Projectiles – Greatest height	5.1m
	3a				M2 Projectiles – time ball above 2.5m	$0.22 < t < 1.8$
	3b				M2 Projectiles – closest distance to catch at 2.5m	44m
	4a				M2 Projectiles – Greatest height	54m
	4b				M2 Projectiles – Furthest distance	43m
	5				M2 Projectiles – Show $V^2 = \ldots$ to clear a wall	PROOF
Consolidation	6a				C4 Integration	$\frac{3}{4}e^{4x+2}+c$
	6b				C4 Integration	$-4e^{4-x}+2x+c$
	6c				C4 Integration	
	7a				C3 Trig exact values given known values	tan A = 4/3
	7b				C3 Trig exact values given known values	sin B = $\frac{\sqrt{5}}{3}$
	7c				C3 Trig exact values given known values	cos(A+B) = $\frac{2}{15}(3-2\sqrt{5})$
	7d				C3 Trig exact values given known values	sin(A+B) = $\frac{1}{15}(8+3\sqrt{5})$
	8a				C3 Trig proof	Proof
	8b				C3 Trig proof	Proof
	9				C3 Differentiation - tangent	y = 9x ln 3 – 18 ln 3
	10				C3 Differentiation – max value	Proof
	11a				C3 Numerical methods	Proof
	11b				C3 Numerical methods	1.58, 1.68, 1.70
	11c				C3 Show root correct	change of sign on f(1.695) and f(1.705)
	12a				C3 Rcos	$5\cos(\theta - 0.927)$
	12bi				C3 Rcos range	$-4 \le f(\theta) \le 6$
	12bii				C3 Rcos solve	$\theta = 1.15, 2.92\ (2dp)$
	12c				C3 Rcos turning point	(0.93, 2/5) and (4.07, -2/5)
	13a				C4 partial fractions	$\frac{1}{1-x} - \frac{3}{1-2x}$
	13b				C4 Binomial expansion	$-2-5x-11x^2-23x^3 + \cdots, valid\ for\ \lvert x\rvert < \frac{1}{2}$

α	β	γ	δ	ε	ζ	η	θ	ι	**κ**	λ	μ	ν	ξ	o	π	ρ	σ	τ	υ	φ	χ	ψ	ω

"The mathematician has reached the highest rung on the ladder of human thought" H Ellis

A2 Maths with Mechanics Assignment κ (kappa)
Due in w/b 28/11

Drill

Part A Integrate with respect to x: use the correct notation

(a) $\cos\frac{3x}{2}$ (b) $\sec^2 x$ (c) $\text{cosec}^2 3x$

Part B Solve the following equations: graphically or otherwise

(a) $|5x - 4| = |x + 3|$ (b) $|x^2 + x| = 6$ (c) $|3x+5| = |5x|$

(d) $|6x-7| = |2x+5|$ (e) $|x^2 - 4| = 3|x|$

Part C Expand each of the following in ascending powers of x up to and including the term in x^3 and state the set of values of x for which each expression is valid.

(a) $(2+x)^{-1}$ (b) $(3-x)^{-3}$ (c) $(8-24x)^{\frac{1}{2}}$ (d) $(4+6x)^{-\frac{1}{2}}$

Part D Express as partial fractions:

(a) $\frac{2x+5}{(x+2)(x+3)}$ (b) $\frac{7x^2+2x-2}{x^2(x+1)}$ (c) $\frac{x+7}{x^2+5x+6}$

Focus from C3 Mock Exam

MEA) Given tanx = p, find in terms of p:

i) sin2x
ii) cos2x
iii) tan2x

MEB) Show that: $\cos\theta \equiv \dfrac{1-\tan^2\frac{\theta}{2}}{1+\tan^2\frac{\theta}{2}}$

MEC) Show that $\sin\theta \equiv \dfrac{2\tan\frac{\theta}{2}}{1+\tan^2\frac{\theta}{2}}$

Current work M2

1. A particle P is projected from a point O on level ground with speed 50 ms^{-1} at an angle ϴ where

sinϴ = $\left(\frac{7}{25}\right)$ above the horizontal. Find

a) the height of P at the point where its horizontal displacement from 0 is 120 m,

b) the speed of P two seconds after projection,

c) the times after projection at which P is moving at an angle of $\tan^{-1}\left(\frac{1}{4}\right)$ to the ground

2. David kicks a ball on a level field with a speed of 20 ms $^{-1}$ at an angle of 30^{o} to the horizontal.

(a) How far away from him does the ball land?

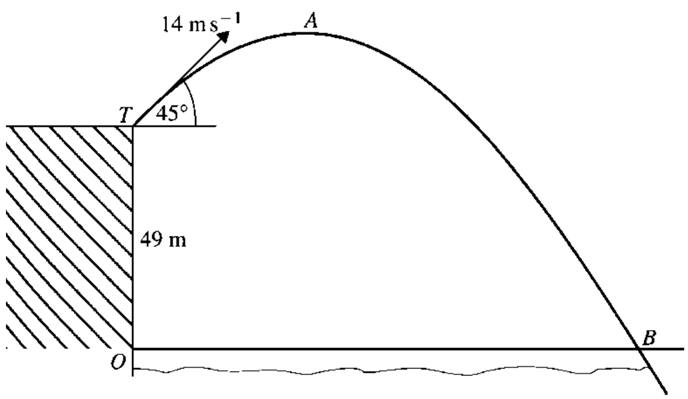
(b) How high does the ball reach?

3. A cricket ball, which may be modelled as a particle moving freely under gravity, is struck from a height of 0.5m above a horizontal field with a velocity of $26ms^{-1}$ at an angle α above the horizontal, where tan α = $^5/_{12}$.

(a) The fielders can reach up to a height of 2.5m. Between what times is the ball out of reach of the fielders?

(b) The captain wishes his fielders to catch the ball as soon as it is within reach. How far from the bat should the fielders be placed in order to do this?

4.



A golf ball is struck from the point T, at the top of a cliff 49 m above sea level, with a speed of 14 m s^{-1} at an angle of 45° to the horizontal, as shown in the diagram. The point O is at sea level and vertically below T. The point A is the highest point reached by the ball in its motion. The ball strikes the sea at the point B.

(a) Find the height A above sea level.

(b) Find the distance OB.

5. A stone thrown from a height of 2m just clears a 6m high wall that is 10m away. Show that the relationship between the speed of projection V and the angle of projection to the horizontal θ can be given by

$$V^2 = \frac{490}{(10\tan\theta - 4)\cos^2\theta}$$

Consolidation

6. Integrate the following w.r.t. x:

(a) $\int 3e^{4x+2}dx$ (b) $\int \left(4e^{4-x} + 2\right)dx$

(c) $\int \frac{e^{2x}+1}{4e^{-x}}dx$ hint: split into $\frac{e^{2x}}{4e^{-x}} + \frac{1}{4e^{-x}}$

7. Given that $\sin A = \frac{4}{5}, 0 < A < 90°$ and that $\cos B = \frac{2}{3}, 0 < B < 90°$, find without using a calculator the value of

(a) tan A (b) sin B (c) cos (A + B) (d) sin(A+B)

8. Prove the following identities:

(a) $\frac{1}{\cos A + \sin A} + \frac{1}{\cos A - \sin A} \equiv \tan 2A \operatorname{cosec} A$

(b) $\cos(A + B) - \cos(A - B) \equiv -2\sin A\sin B$

9. A curve has the equation $y = 3^x$.

Find an equation for the tangent to the curve at the point (2, 9)

10. Show that the curve with equation $y = \frac{\ln x}{x}$ has a maximum value of $\frac{1}{e}$ at $x = e$.

11. $f(x) = x^3 + x^2 - 4x - 1$. The equation $f(x) = 0$ has only one positive root, α.

(a) Show that $f(x) = 0$ can be rearranged as $x = \sqrt{\left(\frac{4x+1}{x+1}\right)}$, $x \neq -1$.

The iterative formula $x_{n+1} = \sqrt{\left(\frac{4x_n+1}{x_n+1}\right)}$ is used to find an approximation to α.

(b) Taking $x_1 = 1$, find, to 2 decimal places, the values of x_2, x_3 and x_4.

(c) Prove that $\alpha = 1.70$, is correct to 2dp.

12. (a) Express $3\cos\theta + 4\sin\theta$ in the form $R\cos(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < \frac{\pi}{2}$

(b) Given that the function f is defined by
$f(\theta) \equiv 1 - 3\cos 2\theta - 4\sin 2\theta, \theta \in \mathbb{R}, 0 \leq \theta \leq \pi$
i) state the range of f,
ii) solve the equation $f(\theta) = 0$

(c) Find the coordinates of the turning points of the curve with equation
$y = \frac{2}{3\cos x + 4\sin x}$ in the interval $[0, 2\pi]$.

13. (a) Express $\frac{x-2}{(1-x)(1-2x)}$ in partial fractions.

(b) Hence find the series expansion of $\frac{x-2}{(1-x)(1-2x)}$ in ascending powers of x up to and including the term in x^3 and state the set of values of x for which the expression is valid.