Name:	Index Number:	Class:

HUA YI SECONDARY SCHOOL

4E **Preliminary Examination** **4E**

ADDITIONAL MATHEMATICS **4049/1**

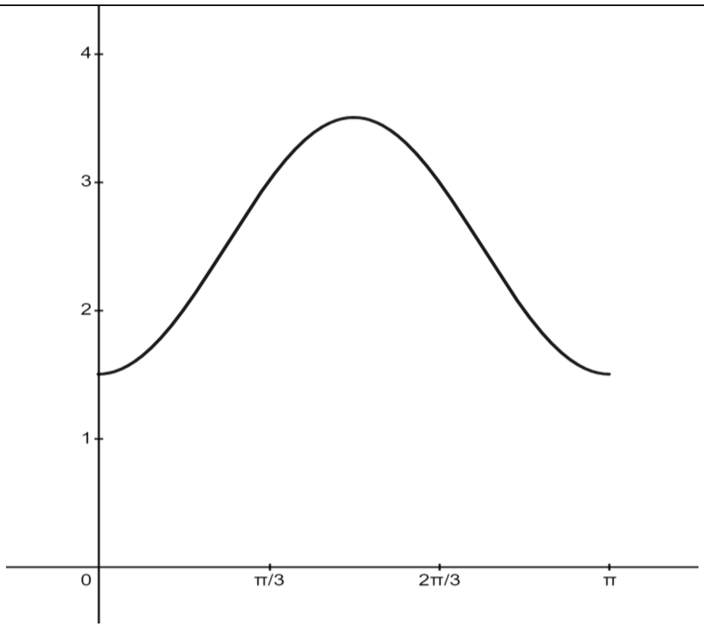
Paper 1

15 September 2021

2 hours 15 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

MARK SCHEME

1	$3x^2 + 5y = 30$ $5y = 30 - 3x^2$ $12x + 15 = 30 - 3x^2$ M1 substitution $x^2 + 4x - 5 = 0$ $(x+5)(x-1) = 0$ M1 factorise quadratic equation $x = -5 \quad x = 1$ M1 attempt to solve for unknown $y = -9 \quad y = \frac{27}{5}$ M1 find corresponding unknown $AB = \sqrt{(1+5)^2 + \left(\frac{27}{5} + 9\right)^2}$ M1 $= 15.6$ units A1
2a)	 B1: 1 complete cycle B1: start and end at $y = 1.5$ B1: fully correct curve
b)	$2.5 - \cos 2x = 1.8$ $\cos 2x = 0.7$ $2x = 0.795398 \quad 2x = 5.487786$ $x = 0.398 \quad x = 2.74$ A1 each
c)	$2.74389 - 0.3976$ M1 $= 2.35$ m A1
3a)	200 mg B1

b)	$\frac{1}{2}=e^{30k}$ M1 $\frac{\ln\frac{1}{2}}{30}=k$ $k=-0.0231$ A1 each
c)	$t=50,$ $A=200e^{-0.02310(50)}$ M1 $=62.99605$ Percentage of amount decayed $=\frac{200-62.99605}{200}\times 100\%$ M1 $=68.5\%$ A1
4	$5+\frac{3x^2+x+8}{x^3+2x}$ M1 $\frac{3x^2+x+8}{x^3+2x}=\frac{A}{x}+\frac{Bx+C}{x^2+2}$ M1 $3x^2+x+8=A\left(x^2+2\right)+\left(Bx+C\right)x$ M1 $x=0,\quad A=4$ A1$\times$2 for finding 2 unknowns : A, B or C correctly $B=-1$ $C=1$ $5+\frac{4}{x}+\frac{1-x}{x^2+2}$ A1
5a)	$y=0$ $x=\frac{9}{4}$ M1 $\frac{dy}{dx}=4\sqrt{x^2+4}+\frac{(4x-9)\times 2x}{2\sqrt{x^2+4}}$ M1 $=\frac{4\left(x^2+4\right)+4x^2-9x}{\sqrt{x^2+4}}$ $=\frac{8x^2-9x+16}{\sqrt{x^2+4}}$ A1 $x=\frac{9}{4}$ $\frac{dy}{dx}=\frac{8\left(\frac{9}{4}\right)^2-9\left(\frac{9}{4}\right)+16}{\sqrt{\left(\frac{9}{4}\right)^2+4}}$ M1 $=12.0$ A1
b)	$\tan^{-1}(12.04159)$ M1 $=85.3°$ A1

6a)	Gradient $= \dfrac{15-0}{4+2}$ M1 $= \dfrac{5}{2}$ $0 = \dfrac{5}{2}(-2)+c$ M1 $c = 5$ $Y = \dfrac{5}{2}X + 5$ $\ln y = \dfrac{5}{2}x^3 + 5$ M1 $y = e^{2.5x^3+5}$ A1
b)	$\ln 11150 = \dfrac{5}{2}x^3 + 5$ M1 $x = 1.20$ A1
7	$p-\sqrt{q} = \left(\dfrac{2}{\sqrt{5}+\sqrt{3}}\right)^2$ M1 $= \dfrac{4}{8+2\sqrt{15}} \times \dfrac{8-2\sqrt{15}}{8-2\sqrt{15}}$ M1 $= \dfrac{32-8\sqrt{15}}{64-4(15)}$ $= \dfrac{32-8\sqrt{15}}{4}$ $= 8-2\sqrt{15}$ $= 8-\sqrt{60}$ $p = 8$ A1 $q = 60$ A1
8a)	$\dfrac{\tan^2 x}{1-\sec x}+1$ $= \dfrac{\sec^2 x - 1}{1-\sec x}+1$ M1 for identity $= \dfrac{(\sec x - 1)(\sec x + 1)}{1-\sec x}+1$ M1 for factorising $= \dfrac{(\sec x - 1)(\sec x + 1)}{-(\sec x - 1)}+1$ $= -\sec x - 1 + 1$ M1 $= -\sec x$

b)	$\dfrac{\tan^2 x}{1-\sec x}+1=\dfrac{3}{2}$ $-\sec x=\dfrac{3}{2}$ M1 $\cos x=-\dfrac{2}{3}$ M1 $\text{basic angle}=48.1896°$ $x=131.8°,\quad 228.2°$ A1 each
9a)	$2x^2+4x+22$ $=2\left(x^2+2x+11\right)$ M1 factorising $=2\left[\left(x+1\right)^2-1+11\right]$ $=2\left(x+1\right)^2+20$ A1 $-x^2-6x-7$ $=-\left(x^2+6x+7\right)$ M1 factorising $=-\left[\left(x+3\right)^2-9+7\right]$ $=-\left(x+3\right)^2+2$ A1
b)	The **<u>minimum point</u>** for $y=2x^2+4x+22$ is $\left(-1, 20\right)$. B1 The **<u>maximum point</u>** for $y=-x^2-6x-7$ is $\left(-3, 2\right)$. B1 [No minimum and maximum point – 1 mark] The maximum of $y=-x^2-6x-7<$ the minimum of $y=2x^2+4x+22$, therefore the two curves will not intersect. B1 for correct argument Diagram may be used as long as all necessary workings are shown.
10a)	$a=\dfrac{dv}{dt}$ $=6t-19$ M1 $t=0,$ $a=-19\,\text{m/s}^2$ A1
b)	$3t^2-19t+26=0$ M1 $\left(3t-13\right)\left(t-2\right)=0$ $t=\dfrac{13}{3},\quad t=2$ A1

c)	$s=\int 3t^2-19t+26\,dt$ $=\frac{3t^3}{3}-\frac{19t^2}{2}+26t+c$ M1 (without c minus 1 mark) $=t^3-\frac{19t^2}{2}+26t+c$ $t=0,\ s=0,\ c=0$ $s=t^3-\frac{19t^2}{2}+26t$ M1 $t^3-\frac{19t^2}{2}+26t=0$ M1 $t\left(t^2-\frac{19t}{2}+26\right)=0$ M1 $t=0$ For $t^2-\frac{19t}{2}+26=0,\quad b^2-4ac=-13.75$ therefore particle will not return to O A1
11a) (i)	$\frac{2\log_2(x-6)}{\log_2 4}+\log_2(x+6)=\log_2 5+\log_2 x$ M1 change of base $\log_2(x-6)+\log_2(x+6)=\log_2 5+\log_2 x$ $\log_2(x-6)(x+6)=\log_2 5x$ M1 apply law of log $x^2-36=5x$ $x^2-5x-36=0$ M1 $(x-9)(x+4)=0$ $x=9\quad x=-4\ (\text{reject})$ A1 (no reject no A1)
(ii)	$\frac{13^x}{13}=\frac{7^2}{7^x}\times 3$ M1 $(13\times 7)^x=49\times 3\times 13$ $91^x=1911$ $x=\log_{91}1911$ M1 $=1.67$ A1

b)	Let $10^{\frac{\lg 5}{2}} = x$ $\log_{10} x = \frac{\lg 5}{2}$ M1 $\lg x = \lg\sqrt{5}$ M1 $x = \sqrt{5}$ OR $\lg 10^{\frac{\lg 5}{2}} = \lg x$ $\frac{\lg 5}{2}\lg 10 = \lg x$ M1 $\lg\sqrt{5} = \lg x$ M1 $x = \sqrt{5}$
12a)	Gradient of $CD = \frac{10+8}{14-2}$ M1 $= \frac{3}{2}$ $0 = \frac{3}{2}(-10) + c$ $c = 15$ $y = \frac{3}{2}x + 15$ A1
b)	mid-point of $AB = (8, 1)$ M1 Gradient of $\perp$ bisector of $AB = -\frac{2}{3}$ $1 = -\frac{2}{3}(8) + c$ M1 $c = \frac{19}{3}$ $y = -\frac{2}{3}x + \frac{19}{3}$ $\frac{2}{3}x + \frac{19}{3} = \frac{3}{2}x + 15$ M1 $x = -4$ $y = 9$ $(-4, 9)$ A1 OR

	mid-point of $AB, M = (8, 1)$ M1 $AMCD$ is a rectangle $\overrightarrow{DC} = \overrightarrow{AM}$ $\overrightarrow{DC} = \begin{pmatrix} 6 \\ 9 \end{pmatrix}$ $C = (-10+6,\ 0+9)$ M1 each $= (-4, 9)$ A1
c)	Area of $ABCD = \frac{1}{2}\begin{vmatrix} -10 & 2 & 14 & -4 & -10 \\ 0 & -8 & 10 & 9 & 0 \end{vmatrix}$ M1 $= 234$ units^2 A1