INDEPENDENT

2002
Higher School Certificate
Trial Examination

Mathematics
Extension 1

General Instructions

- Reading time – 5minutes
- Working time – 2 hours
- Write using black or blue pen
- Board approved calculators may be used
- A table of standard integrals is provided with this paper
- All necessary working should be shown in every question

Total marks - 84

Attempt Questions 1 – 7

All questions are of equal value

This paper MUST **NOT** be removed from the examination room

STUDENT NUMBER/NAME: ....

Student Name/Number: ....

Question 1 **Begin a new page** **Marks**

a. i. Sketch the graph of $y = x^3 - 4x$ **1**

ii. Hence or otherwise, solve $x^3 - 4x > 0$ **2**

b. Find the coordinates of the point which divides the interval joining (2, 4) and $(-1, -2)$ externally in the ratio 2:1. **3**

c. Find the exact value of cos 15° **2**

d. i. Sketch the graph of $y = \tan x$ for $0 \le x \le \pi$ **1**

ii. Hence or otherwise, find values of x $(0 \le x \le \pi)$ such that the series **3**

$$1 + \sqrt{3}\tan x + 3\tan^2 x + 3\sqrt{3}\tan^3 x + \ldots \quad \text{has a limiting sum}$$

Question 2 **Begin a new page**

a. Use the identity $\sin 2x = 2\sin x \cos x$ to find $\int_0^{\frac{\pi}{6}} \sin^2 x \cos^2 x \, dx$ **3**

b. Evaluate $\int_0^1 \frac{4x}{(4x+1)^2}\, dx$, using the substitution $u = 4x + 1$ **3**

c. A, B, C and D are points on the circumference of a circle. AB produced intersects CD produced at a point P. AB = 13 cm, BP = 3 cm and CD = 8 cm

i. Draw a clear sketch showing the above information **1**

ii. Find the length of DP **2**

d. Given $P(x) = x^3 - ax^2 + 4$,

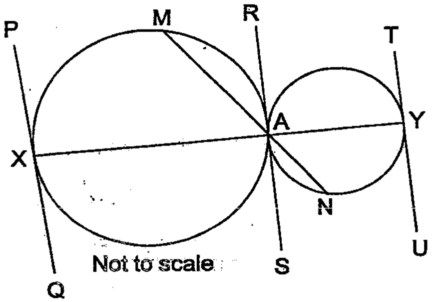
i. find a if $x + 1$ is a factor of $P(x)$ **1**

ii. Hence write $P(x)$ in terms of its linear factors **2**

Student Name/Number: ....

Question 3 **Begin a new page** **Marks**

a. Two circles touch at the point A. Lines through A meet the circles at X and Y and at M and N respectively, as shown. RS, the tangent at A is shown. **4**



Copy the diagram into your workbook.

Prove that the tangents at X and Y are parallel.

b. In how many ways can a jury of 7 people reach a majority decision? **3**

(A majority decision is one to which the majority agree.)

c. Use the Principle of Mathematical Induction to prove that **5**

$$5^n > 3^n + 2^n \text{ for integers } n > 1$$

Question 4 **Begin a new page**

a. i. Show that $x^3 - 3x + 1 = 0$ has a root between $x = 1$ and $x = 2$ **1**

ii. Using $x = 1.5$ as a first approximation, obtain a better approximation of the root using Newton's Method once. [Answer to 2 decimal places] **3**

b. Use $(1 + x)^6 = (1 + x)(1 + x)^5$ to show that $\binom{6}{3} = \binom{5}{3} + \binom{5}{2}$ **3**

c. $P(2ap, ap^2)$ is any point on the parabola $x^2 = 4ay$. The line k is parallel to the tangent at P and passes through the focus, S, of the parabola.

i. Find the equation of the line k **2**

ii. The line k intersects the x-axis at the point Q. Find the coordinates of the midpoint, M, of the interval QS **2**

iii What is the equation of the locus of M? **1**

Student Name/Number: ....

Question 5 **Begin a new page** **Marks**

a. The acceleration, a ms^{-2}, of a particle moving in a straight line is given by the equation, $a = \frac{x^3}{8} + \frac{x}{8}$, where x is the displacement in metres of the particle from the origin. v is the velocity of the particle at any time, t.

i. If $v = ¼$ when $x = 0$, show that $v^2 = \frac{(1 + x^2)^2}{16}$ **3**

ii. If $x = 1$ when $t = 0$, find an expression for the displacement of the particle in terms of t. **3**

b. A population of marsupials has an initial population of 500. Factors which influence the population include birthrates, the number of marsupials killed by feral animals, the amount of feed and so on.

The change in population, N, is given by the formula

$$N = \frac{500}{1 + ke^{-1.5t}}, \text{ where } k \text{ is a constant and } t \text{ is in months}$$

i. Explain why the population will eventually die out **1**

ii. If at $t = 0$, the change in population is 1, use the formula to find how long it will take for only 100 marsupials to remain. Give your answer to the nearest month. **3**

iii. Show that $\frac{dN}{dt} = \frac{3N}{1000}(500 - N)$ **2**

Student Name/Number: ....

Question 6 **Begin a new page** **Marks**

a. In how many different ways can 3 black and 3 white tiles be placed in the following grid: **2**

b. The velocity, v ms^{-1}, of a particle moving along the x-axis in simple harmonic motion is given by $v^2 = 21 - 4x - x^2$, where x is the position of the particle.

i. Between which two points on the x-axis does the particle oscillate? **1**

ii. Find an expression for the acceleration, a ms^{-2}, in terms of x **2**

iii. What is the maximum velocity of the particle? **1**

c. An object is projected at an initial velocity, V ms^{-1}, from ground level at an angle of θ to the horizontal. Use $g = 10$ ms^{-2}

i. Show that the horizontal and vertical components of the position of the particle are given by $x = Vt\cos\theta$ and $y = -5t^2 + Vt\sin\theta$ **2**

ii. Derive an expression for the Cartesian equation for the motion (i.e. find y in terms of x) **2**

iii. A particle is projected from ground level with an initial velocity of 80 ms^{-1}. It just clears a 2 metre high wall 25 metres from the point of projection. The base of the wall is at the same level as the point of projection. **2**

Calculate the angle(s) of projection to the nearest minute.

Student Name/Number: ....

Question 7 **Begin a new page** **Marks**

a. Find $\displaystyle\int_0^{\frac{1}{4}} \frac{4\,dx}{\sqrt{1-4x^2}}$ **2**

b. A machine produces electronic components for computers. Sampling shows that the probability of a particular component being faulty is 8%. In a random sample of 20 components, what is the probability that:

i. exactly 1 component is faulty? Give your answer to 3 decimal places. **1**

ii. less than 3 components are faulty? Give your answer to 3 decimal places **2**

c. i. If $x = a + b$ and $y = a - b$, show that $a = \dfrac{x+y}{2}$ and $b = \dfrac{x-y}{2}$ **1**

ii. Show that $\cos x + \cos y = 2\cos\left(\dfrac{x+y}{2}\right)\cos\left(\dfrac{x-y}{2}\right)$ **2**

iii. Hence find all solutions to $\cos 4\theta + \cos 3\theta + \cos 2\theta + \cos\theta = 0$ for $0 \le \theta \le 2\pi$ **4**

2002 HSC Independent Trial Examinations: Mathematics Extension 1 Sample Solutions and Suggested Marking Scheme

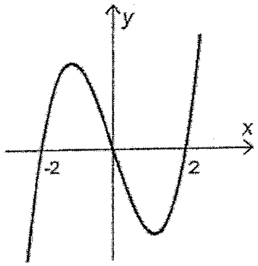
Question 1

a. Outcomes Assessed: i. PE3 ii. PE3

Marking Guidelines

Criteria	Marks
i. • correct graph with intercepts clearly marked.	1
ii. • finds $x > 2$	1
• finds $-2 < x < 0$	1

i.



ii. $-2 < x < 0$ and $x > 2$

b. Outcomes assessed: PE3

Criteria	Marks
• states correct formula	1
• recognises division is external by using -2:1 or equivalent	1
• correct answer	1

$$\left(\frac{kx_2 + lx_1}{k + l}, \frac{ky_2 + ly_1}{k + l}\right) = \left(\frac{-2 \times -1 + 1 \times 2}{-2 + 1}, \frac{-2 \times -2 + 1 \times 4}{-2 + 1}\right) = (-4, -8)$$

c. Outcomes assessed: H5

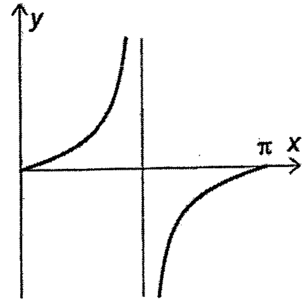
Criteria	Marks
• knows and uses expansion for cos(A − B)	1
• knows exact values and obtains correct answer or equivalent	1

$$\cos 15° = \cos(45 - 30) = \cos 45 \cos 30 + \sin 45 \sin 30 = \frac{\sqrt{2}}{2} \times \frac{\sqrt{3}}{2} + \frac{\sqrt{2}}{2} \times \frac{1}{2} = \frac{\sqrt{6} + \sqrt{2}}{4}$$

d. Outcomes assessed: i. H5 ii. HE1, H5

Criteria	Marks
i. • sketches correct graph with appropriate scales	1
ii. • sets up correct inequality	1
• finds first quadrant solution	1
• finds second quadrant solution	1

i.



ii. $|\sqrt{3}\tan x| < 1$ since $r = \sqrt{3}\tan x$

$$|\tan x| < \frac{1}{\sqrt{3}}$$

$$\therefore 0 < x < \frac{\pi}{6}, \quad \frac{5\pi}{6} < x < \pi$$

Question 2

a. Outcomes assessed: HE6

Criteria	Marks
• uses the identity for $\sin^2\theta$ to change the integral	1
• obtains correct integral	1
• substitutes and obtains correct answer	1

$$\int_0^{\frac{\pi}{6}} \sin^2 x \cos^2 x \, dx = \int_0^{\frac{\pi}{6}} \frac{1}{4} \sin^2 2x \, dx = \frac{1}{4}\int_0^{\frac{\pi}{6}} \frac{1}{2}(1 - \cos 4x)\, dx$$

$$= \frac{1}{8}\left[x - \frac{\sin 4x}{4}\right]_0^{\frac{\pi}{6}} = \frac{1}{8}\left[\frac{\pi}{6} - \frac{\sin\frac{4\pi}{6}}{4} - 0\right] = \frac{1}{8}\left[\frac{\pi}{6} - \frac{\sqrt{3}}{8}\right]$$

b. Outcomes assessed: HE6

Criteria	Marks
• evaluates limits and expression for dx	1
• correctly substitutes to obtain integral in u	1
• evaluates integral	1

Question 2 (continued)

b. $u = 4x + 1; \quad 4x = u - 1$

$\frac{du}{dx} = 4; \quad x = 0 \Rightarrow u = 1$

$\frac{du}{4} = dx; \quad x = 1 \Rightarrow u = 5$

$$I = \int_0^1 \frac{4x}{(4x+1)^2}\,dx$$

$$= \frac{1}{4}\int_1^5 \frac{u-1}{u^2}\,du$$

$$= \frac{1}{4}\int_1^5 \frac{1}{u} - \frac{1}{u^2}\,du$$

$$= \frac{1}{4}\left[\log u + \frac{1}{u}\right]_1^5$$

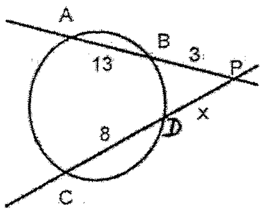
$$= \frac{1}{4}\left(\log 5 - \frac{4}{5}\right)$$

$$= \frac{1}{20}(5\log 5 - 4)$$

c. Outcomes assessed: **i. PE6** **ii. PE3**

Criteria	Marks
i. • draws correct diagram	1
ii. • knows AP.BP = CP.DP and correctly uses it	1
• evaluates x and chooses appropriate solution	1

i.



ii. $AP.PB = CP.DP$

$16 \times 3 = (x + 8) \times x$

$\therefore x^2 + 8x - 48 = 0$

$\Rightarrow x = -12, 4$

so $x = 4$

d. Outcomes assessed: **i. PE3** **ii. PE3**

Criteria	Marks
i. • finds correct value for a	1
ii. • uses a correct method (implicit or explicit)	1
• obtains factorisation	1

i. $P(-1) = (-1)^3 - a \times (-1)^2 + 4 = 0$

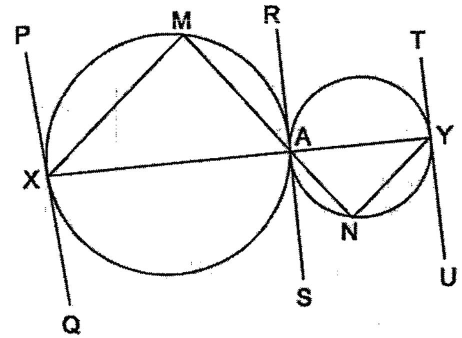
$a = 3$

ii. $P(x) = (x + 1)(x - 2)(x - 2)$

Question 3

a. Outcomes assessed: PE3

Criteria	Marks
• constructs XM and YN	1
• shows that ∠UYN = ∠PXM using appropriate reasoning	1
• shows that ∠AYN = ∠MXA using appropriate reasoning	1
• concludes PQ is parallel to TU with reason	1



∠UYN = ∠YAN (alt. segment thm)
∠YAN = ∠MAX (vert. opp)
∠MAX = ∠PXM (alt. segment thm)
∴ ∠UYN = ∠PXM

Also, ∠AYN = ∠SAN (alt.segment thm)
∠SAN = ∠RAM (vert. opp)
∠RAM = ∠MXA (alt. segment thm)
∴ ∠AYN = ∠MXA

∴ ∠UYN + ∠AYN = ∠PXM + ∠MXA
i.e ∠UYA = ∠PXA
and TU ∥ PQ (alternate angles are equal)

b. Outcomes assessed: PE3

Criteria	Marks
• interprets what majority means	1
• writes down correct combinations	1
• calculates the answer	1

Majority decision means all 7 vote 'yes' or 6 vote 'yes' or 5 vote 'yes' or 4 vote 'yes':

No of ways = $\binom{7}{7} + \binom{7}{6} + \binom{7}{5} + \binom{7}{4} = 64$

c. Outcomes assessed: HE2

Criteria	Marks
• shows true for $n = 2$	1
• writes assumption for S_k	1
• uses S_k in proof for S_{k+1}	1
• proves S_{k+1}	1
• writes concluding statement	1

Question 3 c. (continued)

Let S_n be the statement $5^n > 2^n + 3^n$ for integers $n > 1$

S_2: $5^2 > 2^2 + 3^2$ is true

Assume S_k i.e. assume that $5^k > 2^k + 3^k$ for integers k

Then $5^{k+1} = 5 \times 5^k > 5 \times (2^k + 3^k)$ since S_k is true

i.e. $5^{k+1} > 5 \times 2^k + 5 \times 3^k$

so $5^{k+1} > 2 \times 2^k + 3 \times 2^k + 3 \times 3^k + 2 \times 3^k$

$5^{k+1} > [2^{k+1} + 3^{k+1}] + 3 \times 2^k + 2 \times 3^k$

i.e. $5^{k+1} > 2^{k+1} + 3^{k+1}$

Therefore, if S_k is true, then S_{k+1} is true.

But S_2 is true so S_3 is true and so on for all integer values of $n > 1$

Question 4

a. Outcomes assessed: **i. PE3** **ii. HE3**

		Criteria	Marks
i.	•	substitutes $x = 1$ and $x = 2$ and draws appropriate conclusion	1
ii.	•	states Newton's Method	1
	•	substitutes into the formula	1
	•	evaluates x_1 to 2 decimal places	1

i. If $P(x) = x^3 - 3x + 1$

$P(1) = 1 - 3 + 1 = -1$

$P(2) = 8 - 6 + 1 = 3$

Therefore, a root lies between $x = 1$ and $x = 2$

ii. $x_1 = x - \dfrac{P(x)}{P'(x)}$

$= x - \dfrac{x^3 - 3x + 1}{3x^2 - 3}$

$= 1.5 - \dfrac{1.5^3 - 3 \times 1.5 + 1}{3 \times 1.5^2 - 3} = 1.533333333$

$\therefore x_1 = 1.53$

b. Outcomes assessed: **HE3**

	Criteria	Marks
•	expands $(1 + x)^6$ and $(1 + x)^5$	1
•	finds coefficient of x^3	1
•	draws conclusion	1

$(1 + x)^6 = 1 + \binom{6}{1}x + \binom{6}{2}x^2 + \binom{6}{3}x^3 + \binom{6}{4}x^4 + \binom{6}{5}x^5 + \binom{6}{6}x^6$

$(1 + x)(1 + x)^5 = (1 + x)(1 + \binom{5}{1}x + \binom{5}{2}x^2 + \binom{5}{3}x^3 + \binom{5}{4}x^4 + \binom{5}{5}x^5)$

From the expansion of $(1 + x)^6 = (1 + x)(1 + x)^5$, the x^3 terms are as follows:

Question 4 b (continued)

LHS: $\binom{6}{3}x^3$ RHS: $1 \times \binom{5}{3}x^3 + x \times \binom{5}{2}x^2$ $\therefore \binom{6}{3} = \binom{5}{3} + \binom{5}{2}$

c. Outcomes assessed: **i. PE3, PE4** **ii. H5** **iii. PE4**

		Criteria	Marks
i.	•	knows or finds the gradient of the tangent at P	1
	•	finds the equation of k	1
ii.	•	finds the coordinates of Q, the x-intercept	1
	•	finds the coordinates of M, the midpoint	1
iii.	•	states the equation of the locus	1

i. The gradient of the tangent at P is p and S(0, a) so $y - a = p(x - 0) \rightarrow y = px + a$

ii. At Q, $y = 0$ so $x = -\dfrac{p}{a}$; therefore, $M\left(-\dfrac{p}{2a}, \dfrac{a}{2}\right)$ iii. The locus is $y = \dfrac{a}{2}$

Question 5

a. Outcomes assessed: **i. HE5** **ii. HE4, HE5**

		Criteria	Marks
i.	•	knows $a = \dfrac{d}{dx}\left[\tfrac{1}{2}v^2\right]$	1
	•	integrates a and includes c	1
	•	evaluates c and finds the appropriate expression for v^2	1
ii.	•	uses the inverse of $\dfrac{dv}{dt}$ to obtain an appropriate integral	1
	•	obtains the integral and evaluates the constant	1
	•	rearranges the expression to obtain x in terms of t	1

i. $\dfrac{d}{dx}\left[\tfrac{1}{2}v^2\right] = \dfrac{1}{8}(x^3 + x)$

$\dfrac{1}{2}v^2 = \dfrac{1}{8}\left(\dfrac{x^4}{4} + \dfrac{x^2}{2}\right) + c$

when $v = \dfrac{1}{4}$, $x = 0 \Rightarrow c = \dfrac{1}{32}$

$\therefore \dfrac{1}{2}v^2 = \dfrac{x^4}{32} + \dfrac{x^2}{16} + \dfrac{1}{32}$

$v^2 = \dfrac{1}{16}(x^4 + 2x^2 + 1)$

$v^2 = \dfrac{(x^2 + 1)^2}{16}$

ii. Since $v > 0$ when $x = 0$

$v = \dfrac{1 + x^2}{4} = \dfrac{dx}{dt}$

$\dfrac{dt}{dx} = \dfrac{4}{1 + x^2}$

$t = 4\tan^{-1}x + c$

If $t = 0$, $x = 1 \Rightarrow c = -\pi$

$\therefore t = 4\tan^{-1}x - \pi$

$\tan^{-1}x = \dfrac{1}{4}(t + \pi)$

$x = \tan\left[\dfrac{1}{4}(t + \pi)\right]$

b. Outcomes assessed: i. HE2, HE7 ii. HE3 iii. HE3

i.	• shows that as $t \to \infty$, $N \to 500$ so the number of marsupials $\to 0$	1
ii.	• substitutes $N = 1$ and $t = 0$ to find k	1
	• puts $N = 400$, rearranges and takes log of both sides	1
	• finds value for t	1
iii.	• finds correct derivative of $\dot{N}$	1
	• makes appropriate substitutions to obtain result	1

i. as $t \to 0$, $ke^{-1.5t} \to 0$, $N \to 500$

ii. if $t = 0$, $N = 1 \Rightarrow k = 499$

$$400 = \frac{500}{1 + 499e^{-1.5t}}$$

$$1 + 499e^{-1.5t} = 1.25$$

$$e^{-1.5t} = \frac{.25}{499}$$

$$t = \frac{1}{-1.5}\log_e\left(\frac{.25}{499}\right) \approx 5 \text{ months}$$

iii.
$$\frac{dN}{dt} = \frac{-(-1.5ke^{-1.5t}) \times 500}{(1 + ke^{-1.5t})^2}$$
$$= \frac{1.5}{1 + ke^{-1.5t}} \times \frac{500ke^{-1.5t}}{1 + ke^{-1.5t}}$$
$$= \frac{3N}{1000} \times \left(500 - \frac{500}{1 + ke^{-1.5t}}\right)$$
$$= \frac{3N}{1000}(500 - N)$$

Question 6

a. Outcomes assessed: PE3

Criteria	Marks
• considers different possibilities	1
• adjusts for repeated colours	1

If the top row is all the same, then there are 2 possibilities, all black above all white and vice versa;
If the top row contains two of one colour and one of the other, the total number of possibilities (including having them around the other way) is given by $\frac{^3P_3}{2!} \times \frac{^3P_3}{2!} \times 2 = 18$

Total = 20

b. Outcomes assessed: i. HE3 ii. HE3 iii. HE3

	Criteria	Marks
i.	• puts $v = 0$ and solves	1
ii.	• uses $a = \frac{d}{dx}\left[\frac{1}{2}v^2\right]$ to differentiate	1
	• finds the correct expression for a	1
iii.	• puts $x = -2$ (centre of motion) and evaluates v	1

i. $v = 0 \Rightarrow 21 - 4x - x^2 = 0 \Rightarrow x = -7, 3$ ii. $\frac{1}{2}v^2 = \frac{1}{2}(21 - 4x - x^2) \Rightarrow \frac{d}{dx}\left(\frac{1}{2}v^2\right) = -2 - x$

iii. $x = -2 \Rightarrow v^2 = 21 - 4 \times -2 - (-2)^2 = 25 \Rightarrow v = \pm 5 \therefore v = 5$

Question 6 (continued)

c. Outcomes assessed i. HE3 ii. HE3 iii. HE3

	Criteria	Marks
i.	• sets up acceleration equations, integrates and finds constants of integration	1
	• integrates velocity and finds constants of integration	1
ii.	• finds t in terms of x and substitutes into y	1
	• simplifies to resultant formula	1
iii.	• substitutes $x = 25$, $y = 2$ and $V = 80$ and simplifies	1
	• solves for both values	1

i. Bookwork

ii. Bookwork to $y = x\tan\theta - \frac{5x^2}{V^2}(1 + \tan^2\theta)$

iii. $2 = 25\tan\theta - \frac{5 \times 25^2}{80^2}(1 + \tan^2\theta)$

$3200 = 40000\tan\theta - 3125(1 + \tan^2\theta)$

$128 = 1600\tan\theta - 125 - 125\tan^2\theta$

$\therefore 125\tan^2\theta - 1600\tan\theta + 253 = 0$

$\tan\theta = \frac{1600 \pm \sqrt{2496750}}{250}$

$\theta = 85°30', 4°33'$

Question 7

a. Outcomes assessed: HE4

Criteria	Marks
• finds primitive correctly	1
• substitutes limits and evaluates	1

$$\int_0^{\frac{1}{4}} \frac{4\,dx}{\sqrt{1 - 4x^2}} = 4\left[\frac{1}{2}\sin^{-1}2x\right]_0^{\frac{1}{4}} = 2\sin^{-1}\frac{2}{4} - 2\sin^{-1}0 = \frac{\pi}{3}$$

b. Outcomes assessed i. HE3 ii. HE3

	Criteria	Marks
i.	• uses binomial probability formula with appropriate values and then evaluates it	1
ii.	• understands the possibilities are for 0, 1 or 2 faults and adds results from formula for each	1
	• obtains correct answer	1

i. $\binom{20}{1} \times 0.08^1 \times 0.92^{19} = 0.328$

ii. $\binom{20}{0} \times .08^0 \times .92^{20} + \binom{20}{1} \times .08^1 \times .92^{19} + \binom{20}{2} \times .08^2 \times .92^{18} = 0.788$

Question 7 (continued)

c. Outcomes assessed: i. HE1 **ii. HE1** **iii. HE1, HE7**

	Criteria	Marks
i.	• solves equations to show result	1
ii.	• uses expansions for cos (A − B) and cos (A + B)	1
	• adds these and obtains result as required	1
iii.	• reduces two pairs of terms of the equation to two terms	1
	• reduces this pair of terms to a single term	1
	• breaks equation into simple equations involving cosines and solves $\cos \tfrac{1}{2}\theta = 0$ to obtain $\theta = \pi$	1
	• finds remaining values	1

i. Adding gives $x + y = 2a$ and hence $a = \dfrac{x+y}{2}$, subtracting gives $x - y = 2b$ and $b = \dfrac{x-y}{2}$

ii.

$$\begin{aligned} &\cos x + \cos y \\ &= \cos(a+b) + \cos(a-b) \\ &= \cos a \cos b - \sin a \sin b + \cos a \cos b + \sin a \sin b \\ &= 2\cos a \cos b \\ &= 2\cos\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right) \end{aligned}$$

iii.

$$\begin{aligned} &\cos 4\theta + \cos 3\theta + \cos 2\theta + \cos\theta \\ &= 2\cos\frac{7\theta}{2}\cos\frac{\theta}{2} + 2\cos\frac{3\theta}{2}\cos\frac{\theta}{2} \\ &= 2\cos\frac{\theta}{2}\left(\cos\frac{7\theta}{2} + \cos\frac{3\theta}{2}\right) \\ &= 4\cos\frac{\theta}{2}\cos 5\frac{\theta}{2}\cos\theta = 0 \end{aligned}$$

$\therefore \cos\frac{\theta}{2} = 0 \Rightarrow \frac{\theta}{2} = \frac{\pi}{2} \Rightarrow \theta = \pi$

and $\cos\frac{5\theta}{2} = 0 \Rightarrow \frac{5\theta}{2} = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \frac{7\pi}{2}, \frac{9\pi}{2}$ and $\cos\theta = 0 \Rightarrow \theta = \frac{\pi}{2}, \frac{3\pi}{2}$

hence $\theta = \frac{\pi}{5}, \frac{3\pi}{5}, \pi, \frac{7\pi}{5}, \frac{9\pi}{5}, \frac{\pi}{2}, \frac{3\pi}{2}$

2002 HSC Independent Trial Examinations: Mathematics Extension 1 Mapping Grid

Question	Syllabus Topic	Outcomes
1a.i.	Polynomials (16.1)	PE3
1a.ii.	Basic Arithmetic and Algebra (1.4)	PE3
1b.	Linear Functions and Lines (6.7)	PE3
1c.	Trigonometric Ratios (5.7)	H5!
1d.i.	Trigonometric Functions (13.2)	H5
1d.ii.	Series and Applications (7.3), Trigonometric Ratios (5.9)	HE1, H5
2a.	Trigonometric Functions (13.6)	HE6
2b.	Integration (11.5)	HE6
2c.i.	Plane Geometry (2.1)	PE6
2c.ii.	Plane Geometry (2.9, 2.10)	PE3
2d.i. & ii.	Polynomials (16.2)	PE3
3a.	Plane Geometry (2.9, 2.10)	PE3
3b.	Permutations and Combinations (18.1)	PE3
3c.	Series and Applications (7.4)	HE2
4a.i. & ii.	Polynomials (16.4)	i. PE3; ii. HE3
4b.	Binomial Theorem (17.3)	HE3
4c.	Quadratic Polynomial and Quadratic (9.6)	i. PE4; ii. H5; iii. PE4
5a.	Applications of Calculus to the Physical World (14.3)	i. HE5; ii. HE4, HE5
5b.	Applications of Calculus to the Physical World (14.2)	i. HE2, HE7; ii. HE3; iii. HE3
6a.	Permutations and Combinations (18.1)	PE3
6b.	Applications of Calculus to the Physical World (14.4)	i. HE3; ii. HE3; iii. HE3
6c.	Applications of Calculus to the Physical World (14.3)	i. HE3; ii. HE3; iii. HE3
7a.	Inverse Trigonometric Functions (15.5)	HE4
7b.	Further Probability (18.2)	i. HE3; ii. HE3
7c.i & ii.	Trigonometric Ratios (5.7)	i. HE1; ii. HE1
7c.iii.	Trigonometric Ratios (5.9)	iii. HE1, HE7