



Woodward Street  
PO Box 654, Orange NSW 2800  
P (02) 6362 3444  
F (02) 6361 3616  
www.orange-h.schools.nsw.edu.au

Orange High School

Honour the Past, Create the Future

## Higher School Certificate Assessment Task Cover Sheet

**Student Name:**

**Subject:** Mathematics Advanced    **Year:** Year 12 HSC    **Teacher:** Mrs Beeby and Mr Lummis

**Assessment Task Number (As per Assessment Policy booklet):** 3

**Assessment Task Title:** In Class Task

**Assessment Weighting:** 25%

**Date Notified:** Monday, 9<sup>th</sup> May, 2022 (Week 3)    **Date Due:** Periods 5 and 6 Monday, 23<sup>rd</sup> May, 2022 (Week 5)

*All Higher School Certificate Assessment Tasks, other than in-class tasks, must be handed in at the library between 8.30am and 8.55am (before the first morning bell) on the due date. Zero marks if the Assessment Task is submitted late, unless an Illness/Misadventure or application for extension form has been submitted.*

### Comments by Teacher:

You will be assessed on all work in the Preliminary Mathematics Advanced Course (all Chapters in the Yellow Grove Book (Mathematics Advanced) and Mathematics Advanced Chapters in the Green Grove Book (Extension 1)). Plus, all work studied in the HSC Mathematics Advanced Course thus far (Chapters 1 to 6 of the Yellow Grove Book (Mathematics Advanced) and Chapters 1, 2, 4, 5, 6 and 7 of the Green Grove Book (Extension 1)). The class teacher will let you know which exercises from the particular Chapters of the HSC texts are to be included in the test before the due date.

**A four page NESA formula sheet will be given out with the examination paper (also attached to this notification).**

### Syllabus Outcomes:

MA11-1 to MA11-9, MA12-3 TO MA12-7

### Assessment Criteria/Marking Rubric:

Marks for each question will be clearly shown next to each question in the test paper.

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## Higher School Certificate Assessment Submission Receipt

**Student's Name:**

**Student's Signature**

**Assessment Task Title:**

**Subject Name:**

**Class Teacher:**

**Received in the Library by:**

**Date:**

**This form is located:** [www.orange-h.schools.nsw.edu.au](http://www.orange-h.schools.nsw.edu.au) and then to the assessment tab.

Mathematics Advanced  
Mathematics Extension 1  
Mathematics Extension 2

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REFERENCE SHEET

**Measurement**

**Length**

$$l = \frac{\theta}{360} \times 2\pi r$$

**Area**

$$A = \frac{\theta}{360} \times \pi r^2$$

$$A = \frac{h}{2}(a + b)$$

**Surface area**

$$A = 2\pi r^2 + 2\pi rh$$

$$A = 4\pi r^2$$

**Volume**

$$V = \frac{1}{3}Ah$$

$$V = \frac{4}{3}\pi r^3$$

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**Functions**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

For  $ax^3 + bx^2 + cx + d = 0$ :

$$\alpha + \beta + \gamma = -\frac{b}{a}$$

$$\alpha\beta + \alpha\gamma + \beta\gamma = \frac{c}{a}$$

$$\text{and } \alpha\beta\gamma = -\frac{d}{a}$$

**Relations**

$$(x - h)^2 + (y - k)^2 = r^2$$

**Financial Mathematics**

$$A = P(1 + r)^n$$

**Sequences and series**

$$T_n = a + (n - 1)d$$

$$S_n = \frac{n}{2}[2a + (n - 1)d] = \frac{n}{2}(a + l)$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(1 - r^n)}{1 - r} = \frac{a(r^n - 1)}{r - 1}, r \neq 1$$

$$S = \frac{a}{1 - r}, |r| < 1$$

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**Logarithmic and Exponential Functions**

$$\log_a a^x = x = a^{\log_a x}$$

$$\log_a x = \frac{\log_b x}{\log_b a}$$

$$a^x = e^{x \ln a}$$

## Trigonometric Functions

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \quad \cos A = \frac{\text{adj}}{\text{hyp}}, \quad \tan A = \frac{\text{opp}}{\text{adj}}$$

$$A = \frac{1}{2}ab \sin C$$

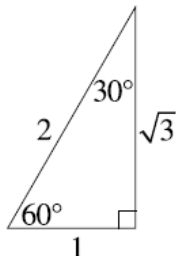
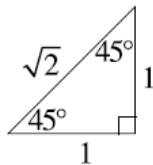
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

$$l = r\theta$$

$$A = \frac{1}{2}r^2\theta$$



### Trigonometric identities

$$\sec A = \frac{1}{\cos A}, \quad \cos A \neq 0$$

$$\operatorname{cosec} A = \frac{1}{\sin A}, \quad \sin A \neq 0$$

$$\cot A = \frac{\cos A}{\sin A}, \quad \sin A \neq 0$$

$$\cos^2 x + \sin^2 x = 1$$

### Compound angles

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\text{If } t = \tan \frac{A}{2} \text{ then } \sin A = \frac{2t}{1+t^2}$$

$$\cos A = \frac{1-t^2}{1+t^2}$$

$$\tan A = \frac{2t}{1-t^2}$$

$$\cos A \cos B = \frac{1}{2}[\cos(A - B) + \cos(A + B)]$$

$$\sin A \sin B = \frac{1}{2}[\cos(A - B) - \cos(A + B)]$$

$$\sin A \cos B = \frac{1}{2}[\sin(A + B) + \sin(A - B)]$$

$$\cos A \sin B = \frac{1}{2}[\sin(A + B) - \sin(A - B)]$$

$$\sin^2 nx = \frac{1}{2}(1 - \cos 2nx)$$

$$\cos^2 nx = \frac{1}{2}(1 + \cos 2nx)$$

## Statistical Analysis

$$z = \frac{x - \mu}{\sigma}$$

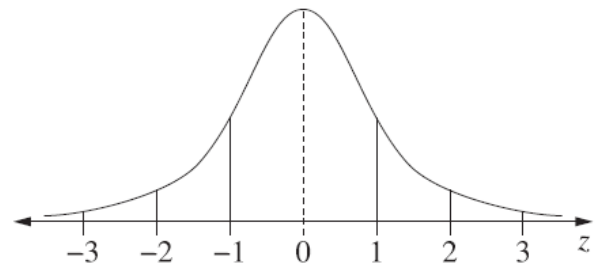
An outlier is a score

less than  $Q_1 - 1.5 \times IQR$

or

more than  $Q_3 + 1.5 \times IQR$

### Normal distribution



- approximately 68% of scores have  $z$ -scores between  $-1$  and  $1$
- approximately 95% of scores have  $z$ -scores between  $-2$  and  $2$
- approximately 99.7% of scores have  $z$ -scores between  $-3$  and  $3$

$$E(X) = \mu$$

$$\operatorname{Var}(X) = E[(X - \mu)^2] = E(X^2) - \mu^2$$

### Probability

$$P(A \cap B) = P(A)P(B)$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}, \quad P(B) \neq 0$$

### Continuous random variables

$$P(X \leq x) = \int_a^x f(x) dx$$

$$P(a < X < b) = \int_a^b f(x) dx$$

### Binomial distribution

$$P(X = r) = {}^n C_r p^r (1-p)^{n-r}$$

$$X \sim \operatorname{Bin}(n, p)$$

$$\Rightarrow P(X = x)$$

$$= \binom{n}{x} p^x (1-p)^{n-x}, \quad x = 0, 1, \dots, n$$

$$E(X) = np$$

$$\operatorname{Var}(X) = np(1-p)$$

## Differential Calculus

### Function

### Derivative

$$y = f(x)^n$$

$$\frac{dy}{dx} = n f'(x) [f(x)]^{n-1}$$

$$y = uv$$

$$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$$

$$y = g(u) \text{ where } u = f(x)$$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

$$y = \frac{u}{v}$$

$$\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

$$y = \sin f(x)$$

$$\frac{dy}{dx} = f'(x) \cos f(x)$$

$$y = \cos f(x)$$

$$\frac{dy}{dx} = -f'(x) \sin f(x)$$

$$y = \tan f(x)$$

$$\frac{dy}{dx} = f'(x) \sec^2 f(x)$$

$$y = e^{f(x)}$$

$$\frac{dy}{dx} = f'(x) e^{f(x)}$$

$$y = \ln f(x)$$

$$\frac{dy}{dx} = \frac{f'(x)}{f(x)}$$

$$y = a^{f(x)}$$

$$\frac{dy}{dx} = (\ln a) f'(x) a^{f(x)}$$

$$y = \log_a f(x)$$

$$\frac{dy}{dx} = \frac{f'(x)}{(\ln a) f(x)}$$

$$y = \sin^{-1} f(x)$$

$$\frac{dy}{dx} = \frac{f'(x)}{\sqrt{1-[f(x)]^2}}$$

$$y = \cos^{-1} f(x)$$

$$\frac{dy}{dx} = -\frac{f'(x)}{\sqrt{1-[f(x)]^2}}$$

$$y = \tan^{-1} f(x)$$

$$\frac{dy}{dx} = \frac{f'(x)}{1+[f(x)]^2}$$

## Integral Calculus

$$\int f'(x) [f(x)]^n dx = \frac{1}{n+1} [f(x)]^{n+1} + c$$

where  $n \neq -1$

$$\int f'(x) \sin f(x) dx = -\cos f(x) + c$$

$$\int f'(x) \cos f(x) dx = \sin f(x) + c$$

$$\int f'(x) \sec^2 f(x) dx = \tan f(x) + c$$

$$\int f'(x) e^{f(x)} dx = e^{f(x)} + c$$

$$\int \frac{f'(x)}{f(x)} dx = \ln |f(x)| + c$$

$$\int f'(x) a^{f(x)} dx = \frac{a^{f(x)}}{\ln a} + c$$

$$\int \frac{f'(x)}{\sqrt{a^2 - [f(x)]^2}} dx = \sin^{-1} \frac{f(x)}{a} + c$$

$$\int \frac{f'(x)}{a^2 + [f(x)]^2} dx = \frac{1}{a} \tan^{-1} \frac{f(x)}{a} + c$$

$$\int u \frac{dv}{dx} dx = uv - \int v \frac{du}{dx} dx$$

$$\int_a^b f(x) dx$$

$$\approx \frac{b-a}{2n} \{f(a) + f(b) + 2[f(x_1) + \dots + f(x_{n-1})]\}$$

where  $a = x_0$  and  $b = x_n$

## Combinatorics

$${}^n P_r = \frac{n!}{(n-r)!}$$

$$\binom{n}{r} = {}^n C_r = \frac{n!}{r!(n-r)!}$$

$$(x+a)^n = x^n + \binom{n}{1}x^{n-1}a + \cdots + \binom{n}{r}x^{n-r}a^r + \cdots + a^n$$

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## Vectors

$$|\underline{u}| = |x\underline{i} + y\underline{j}| = \sqrt{x^2 + y^2}$$

$$\underline{u} \cdot \underline{v} = |\underline{u}| |\underline{v}| \cos \theta = x_1 x_2 + y_1 y_2,$$

$$\text{where } \underline{u} = x_1 \underline{i} + y_1 \underline{j}$$

$$\text{and } \underline{v} = x_2 \underline{i} + y_2 \underline{j}$$

$$\underline{r} = \underline{a} + \lambda \underline{b}$$

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## Complex Numbers

$$z = a + ib = r(\cos \theta + i \sin \theta) \\ = r e^{i\theta}$$

$$[r(\cos \theta + i \sin \theta)]^n = r^n (\cos n\theta + i \sin n\theta) \\ = r^n e^{in\theta}$$

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## Mechanics

$$\frac{d^2 x}{dt^2} = \frac{dv}{dt} = v \frac{dv}{dx} = \frac{d}{dx} \left( \frac{1}{2} v^2 \right)$$

$$x = a \cos(nt + \alpha) + c$$

$$x = a \sin(nt + \alpha) + c$$

$$\ddot{x} = -n^2(x - c)$$