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Orange High School

Honour the Past, Create the Future

## Higher School Certificate Assessment Task Cover Sheet

**Student Name:**

**Subject:** Mathematics Extension 1    **Year:** Year 12 HSC    **Teacher:** Mrs Beeby

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

**Assessment Task Title:** In Class Task

**Assessment Weighting:** 25%

**Date Notified:** Monday, 23<sup>rd</sup> May, 2022 (Week 5) **Date Due:** Periods 5 and 6 Monday, 6<sup>th</sup> June, 2022 (Week 7)

*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 Extension 1 Course (all Extension 1 Questions/Exercises/Chapters in the Preliminary Grove Book) and all work studied in the HSC Extension 1 Course thus far (Ex 1:07, Chapter 3, Ex 4:04, Ex 4:05, Ex 5:09, Ex 5:10 and Chapter 8. Plus, any additional Extension 1 questions within Chapters 1, 2, 4 to 7 of the HSC Grove Book).

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

### Syllabus Outcomes:

ME11-1 to ME11-7, ME12-1 to ME12-4 and ME12-7

### 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

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

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

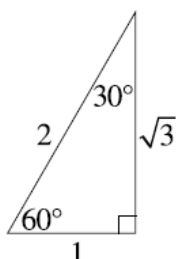
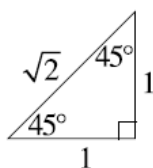
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

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

$$l = r\theta$$

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



## 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

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

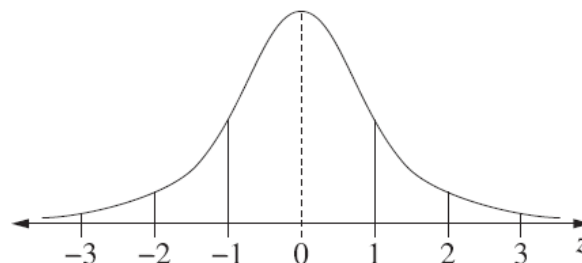
An outlier is a score

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

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

$$y = uv$$

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

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

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

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

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

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

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

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

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

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

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

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

### Derivative

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## 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

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

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

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

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