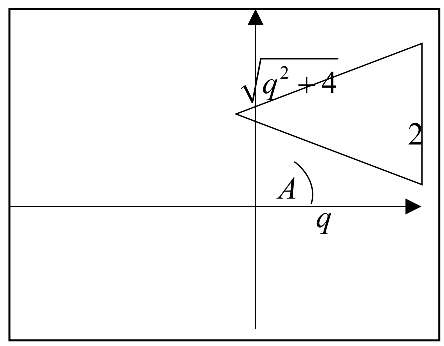
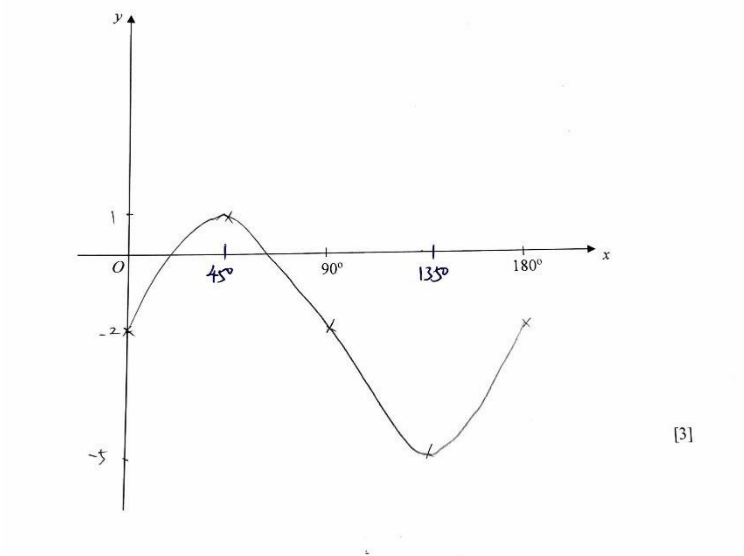
SEMBAWANG SECONDARY SCHOOL
SEC 4NA PRELIMINARY EXAMINATION 2025
ADDITIONAL MATHEMATICS P1 MARKING SCHEME

Qn	Solution
1(i)	$\frac{5\sqrt{7}+2}{3+\sqrt{7}} \times \frac{(3-\sqrt{7})}{(3-\sqrt{7})}$ $= \frac{15\sqrt{7}-(5)(7)+6-2\sqrt{7}}{9-7}$ $= \frac{13\sqrt{7}-29}{2}$ $= -\frac{29}{2}+\frac{13}{2}\sqrt{7}$
2(a)	$\tan A = \frac{2}{q}$ $\sec A = \frac{1}{\cos A}$ $= \frac{1}{\frac{q}{\sqrt{q^2+4}}}$ $= \frac{\sqrt{q^2+4}}{q}$ 
2(b)	$\sin 2A = 2\sin A \cos A$ $= 2\left(\frac{2}{\sqrt{q^2+4}}\right)\left(\frac{q}{\sqrt{q^2+4}}\right)$ $= \frac{4q}{q^2+4}$

3	$xy = 2 + y^2 \quad --(1)$ $2y = x - 1 \quad --(2)$ From(2): $x = 2y + 1 \quad --(3)$ Sub(3) into(1): $y(2y+1) = 2 + y^2$ $2y^2 + y - y^2 - 2 = 0$ $y^2 + y - 2 = 0$ $(y+2)(y-1) = 0$ $y = -2$ or $y = 1$ $x = -3$ or $x = 3$
4	$\frac{dV}{dt} = 0.5$ $\frac{dV}{dx} = 2\pi x^2$ When $x = 0.8$, $\frac{dV}{dx} = 2\pi(0.8)^2$ $= 1.28\pi$ $\frac{dV}{dt} = \frac{dV}{dx} \times \frac{dx}{dt}$ $0.5 = 1.28\pi \times \frac{dx}{dt}$ $\frac{dx}{dt} = \frac{0.5}{1.28\pi}$ $\frac{dx}{dt} = \frac{0.5}{1.28\pi}$ $= 0.124\text{m/h}$
5(a)	$f(3): 2(3)^4 - (3)^3 - 19(3)^2 + 3m + n$ $0 = -36 + 3m + n$ $3m + n = 36 ----> (1)$ $f(-3): 2(-3)^4 - (-3)^3 - 19(-3)^2 - 3m + n$ $-3m + n = -18 ----> (2)$ $(1) + (2): 2n = 18$ $n = 9$ $m = 9$

5(a)	By long division method: $\mathrm{f}(x)=(x^2-9)(2x^2-x-1)$ $\quad =(x+3)(x-3)(2x+1)(x-1)$
6	$\frac{3x-2}{x(x-1)^2}=\frac{A}{x}+\frac{B}{x-1}+\frac{C}{(x-1)^2}$ $3x-2=A(x-1)^2+B(x)(x-1)+C(x)$ When $x = 0$, $-2 = A$ When $x = 1$, $C = 1$ When $x = 2$, $B = 2$ $\therefore \frac{3x-2}{x(x-1)^2}=\frac{-2}{x}+\frac{2}{x-1}+\frac{1}{(x-1)^2}$

7	$y=(3-x^2)\sqrt{2+x}$ $y=(3-x^2)(2+x)^{\frac{1}{2}}$ $\frac{dy}{dx}=(3-x^2)\frac{1}{2}(2+x)^{-\frac{1}{2}}+(2+x)^{\frac{1}{2}}(-2x)$ When $x=2$, $\frac{dy}{dx}=(3-2^2)\frac{1}{2}(2+2)^{-\frac{1}{2}}+(2+2)^{\frac{1}{2}}(-2(2))$ $=-\frac{33}{4}$ Gradient of normal $=-1\div-\frac{33}{4}$ $=\frac{4}{33}$ When $x=2$, $y=(3-2^2)\sqrt{2+2}$ $=-2$ Sub $x=2$ and $y=-2$ into $y=\frac{4}{33}x+c$ $-2=\frac{4}{33}(2)+c$ $c=-\frac{74}{33}$ Eqn of normal : $y=\frac{4}{33}x-\frac{74}{33}$
8(a)	Amplitude = 3 Period = 180°

8(b)	Correct Shape Amplitude, period x, y intercepts 
9	$\cos 2x + 7\sin x - 4 = 0$ $1 - 2\sin^2 x + 7\sin x - 4 = 0$ $2\sin^2 x - 7\sin x + 3 = 0$ $(2\sin x - 1)(\sin x - 3) = 0$ $\sin x = \frac{1}{2}$ or $\sin x = 3$ (rejected) $Basic\angle = 30°$ $x = 30°, 150°$
10(a)	$\mathrm{f}(x) = \int (3x^2 + 4x - 4)\,dx$ $= \frac{3x^3}{3} + \frac{4x^2}{2} - 4x + c$ $= x^3 + 2x^2 - 4x + c$ $5 = 1 + 2 - 4 + c$ $c = 6$ $\mathrm{f}(x) = x^3 + 2x^2 - 4x + 6$

10(b)	$\int_1^2 \left(x^3+2x^2-4x+6\right)\mathrm{d}x$ $=\left[\dfrac{x^4}{4}+\dfrac{2}{3}x^3-2x^2+6x\right]_1^2$ $=\left[\dfrac{2^4}{4}+\dfrac{2}{3}(2)^3-2(2)^2+6(2)\right]-\left[\dfrac{1}{4}+\dfrac{2}{3}-2+6\right]$ $=\dfrac{101}{12}$
11(a)(i)	$\dfrac{\pi}{4}$
11(a)(ii)	$-\dfrac{\pi}{3}$
11(b)	Since principal value of $\cos^{-1}\theta$ is between 0 and π, it is not possible for the principal value of $\cos^{-1}\left(-\dfrac{\sqrt{2}}{2}\right)$ to be $-\dfrac{\pi}{4}$. Or principal value of $\cos^{-1}\left(-\dfrac{\sqrt{2}}{2}\right)$ is $\dfrac{3\pi}{4}$ so it cannot be $-\dfrac{\pi}{4}$.
11(c)(i)	$\dfrac{1}{\sin x+1}-\dfrac{1}{\sin x-1}$ $=\dfrac{\sin x-1-(\sin x+1)}{(\sin x+1)(\sin x-1)}$ $=\dfrac{-2}{\sin^2 x-1}$ $=\dfrac{-2}{1-\cos^2 x-1}$ $=\dfrac{-2}{-\cos^2 x}$ $=2\sec^2 x$

11(c)(i)	$\frac{1}{\sin 2x+1}-\frac{1}{\sin 2x-1}=3$ $2\sec^2 2x=3$ $\sec^2 2x=\frac{3}{2}$ $\cos^2 2x=\frac{2}{3}$ $\cos 2x=\pm\sqrt{\frac{2}{3}}$ basic angle = 0.615479 $2x=0.61547,\ 2.52611,\ 3.75707,\ 5.66771$ $x=0.308,\ 1.26,\ 1.88,\ 2.83$ (to 3s.f.)
12(a)	$\frac{d}{dx}\left(2\sqrt{x}-3\right)^7$ $=7\left(2\sqrt{x}-3\right)^6\left(x^{-\frac{1}{2}}\right)$ $=\frac{7\left(2\sqrt{x}-3\right)^6}{x^{\frac{1}{2}}}$ or $\frac{7\left(2\sqrt{x}-3\right)^6}{\sqrt{x}}$
12(b)	$\int_1^4 \frac{7\left(2\sqrt{x}-3\right)^6}{x^{\frac{1}{2}}}dx$ $=\left[\left(2\sqrt{x}-3\right)^7\right]_1^4$ $=\left(2\sqrt{4}-3\right)^7-\left(2-3\right)^7$ $=1-(-1)$ $=2$ $\int_1^4 \frac{\sqrt{x}\left(2\sqrt{x}-3\right)^6}{x}dx=\frac{2}{7}$

13(a)	$y=-x^2+2x+9$ $y=-\left(x^2-2x-9\right)$ $y=-\left[x^2-2x+(1)^2-(1)-9\right]$ $y=-\left[(x-1)^2-10\right]$ $y=-(x-1)^2+10$ Maximum value: 10m $x = 1$
13(b)	$-(x-1)^2+10=0$ $(x-1)^2=10$ $x-1=\pm\sqrt{10}$ $x=4.16\text{ m}$ or $x=-2.16$ It takes 4.16m for the stone to reach sea level