Assessment Schedule – 2008

Calculus: Differentiate functions and use derivatives to solve problems (90635)

Evidence Statement

	Achievement Criteria	Q.	Evidence	Code	Judgement	Sufficiency
Achievement	Differentiate functions and use derivatives to solve problems.	ONE (a)	$\frac{dy}{dx} = \frac{1}{2}(x^2 - x)^{\frac{-1}{2}}(2x-1)$	A1	Or equivalent.	**Achievement:** **Three** of Code A **including** at least **one** of Code A1 **and** at least **one** of Code A2.
		(b)	$\frac{dy}{dx} = \frac{(x^3-x).3\cos 3x - \sin 3x.(3x^2-1)}{(x^3-x)^2}$	A1	Or equivalent.	
		TWO	$\frac{dH}{dw} = 12 - 0.24e^{0.2w}$	A1	Must have derivative.	
			Maximum when $\frac{dH}{dw} = 0$	OR		
			$12 - 0.24e^{0.2w} = 0$ $\ln 50 = 0.2w$ $w = 19.56$	A2	Or equivalent. Units not required.	
		THREE	$\frac{dP}{dt} = -8t - \frac{3000}{2t+1}$	A1	Must have derivative.	
			At $t = 3$,	OR		
			$\frac{dP}{dt} = -452.57$ possums per month	A2	Accept 452 or 453. Accept + or – Units not required.	

	Achievement Criteria	Q.	Evidence	Code	Judgement	Sufficiency
Achievement with Merit	Demonstrate knowledge of advanced concepts and techniques of differentiation and solve differentiation problems.	FOUR	$\frac{dx}{dt} = 2\sec^2 t$ $\frac{dy}{dt} = 6\cos 2t$	A1		**Merit:** Achievement
			OR			PLUS
			$\frac{dy}{dx} = \frac{6\cos 2t}{2\sec^2 t}$ $= 3\cos 2t \,.\, \cos^2 t$	M1	Or equivalent.	Two of Code M
			OR			OR
			At $t = \frac{\pi}{6}$, $\frac{dy}{dx} = \frac{9}{8}$	A2 M2	Or equivalent.	Three of Code M including
		FIVE (a)	$a = -2$ and $a = 6$		Accept $x = -2$ and $x = 6$ for (a).	at least one of Code M1
		(b)(i)	$x < -2$ and $x = 7$	M1	Need 3 of questions 5(a) , (b)(i), (b)(ii) and (b)(iii) completely correct.	AND
		(b)(ii)	$x > 6$			at least one of Code M2.
		(b)(iii)	$x = 0$ and $x = 3$			
		SIX	$w^2 + d^2 = 225$ $d^2 = 225 - w^2$ $S = k\left(225 - w^2\right)w$ $= k\left(225w - w^3\right)$			
			$\frac{dS}{dW} = k\left(225 - 3w^2\right)$		Must have derivative.	
			Turning point when $\frac{dS}{dw} = 0$			
			$225 - 3w^2 = 0$ $w = \sqrt{75} = 5\sqrt{3} = 8.660$ cm		A2 for one dimension.	
			$d = \sqrt{150} = 5\sqrt{6} = 12.247$ cm	A2 M2	Need both answers. Or equivalent. Units not required.	

	Achievement Criteria	Q.	Evidence	Code	Judgement	Sufficiency
Achievement with Excellence	Solve more complex differentiation problem(s).	SEVEN	$\frac{x^2}{9}+y^2=1 \qquad y=\sqrt{1-\frac{x^2}{9}}$ Area = $4xy=4x\sqrt{1-\frac{x^2}{9}}$ $\frac{dA}{dx}=4x.\frac{1}{2}\left(1-\frac{x^2}{9}\right)^{-\frac{1}{2}}.-\frac{2x}{9}+4\left(1-\frac{x^2}{9}\right)^{\frac{1}{2}}$ Turning point when $A'(x)=0$ $\frac{x^2}{9}=1-\frac{x^2}{9}$ $x=\frac{3}{\sqrt{2}}$ and $y=\frac{1}{\sqrt{2}}$ Area = $2\times\frac{3}{\sqrt{2}}\times 2\times\frac{1}{\sqrt{2}}=6\text{ m}^2$	A1 M1 OR A2 M2 OR E	Accept any valid method. Ignore minor arithmetic error. Dimensions without area. Units not required.	**Excellence:** **Either** Merit **PLUS** **One** of Code E **OR** **Two** of code E.
		EIGHT	$\cos\theta=\frac{S}{L}$ $I=\frac{600S}{L^3}$ $=600S(S^2+1.8^2)^{\frac{-3}{2}}$ $\frac{dI}{dS}=-1800S^2\left(S^2+3.24\right)^{-\frac{5}{2}}+600\left(S^2+3.24\right)^{-\frac{3}{2}}$ $=-\frac{1800S^2}{\left(\sqrt{S^2+3.24}\right)^5}+\frac{600S^2}{\left(\sqrt{S^2+3.24}\right)^3}$ At $S=1.59$ m $S^2=2.52$ L = 2.4 $\frac{dL}{dS}=-\frac{1800\times 2.52}{2.4^5}+\frac{600}{2.4^3}$ = -13.56 $\frac{dI}{dt}=\frac{dI}{dS}\times\frac{dS}{dt}$ = -13.56 × -0.6 = 8.138 Lux s^{-1}	A1 M1 OR A2 M2 E	Also A1 for: Chain rule $\frac{dL}{dS}=\frac{S}{\sqrt{S^2+3.24}}$ Simple implicit $\frac{dL}{dS}=\frac{S}{L}$ Also M1 for: - quotient and implicit, $\frac{dI}{dt}$ - derivative of trig product $\frac{dI}{d\theta}$ Units not required. Ignore ±	

Judgement Statement

Achievement	Achievement with Merit	Achievement with Excellence
Differentiate functions and use derivatives to solve problems. $3 \times$ A including at least $1 \times$ A1 and $1 \times$ A2	Demonstrate knowledge of advanced concepts and techniques of differentiation and solve differentiation problems. Achievement plus $2 \times$ M including at least $1 \times$ M1 and $1 \times$ M2 OR $3 \times$ M including at least $1 \times$ M1 and $1 \times$ M2	Solve more complex differentiation problem(s). Achievement with Merit plus $1 \times$ E OR $2 \times$ E

The following Mathematics-specific marking conventions may also have been used when marking this paper:

- Errors are circled.
- Omissions are indicated by a caret (^).
- **NS** may have been used when there was not sufficient evidence to award a grade.
- **CON** may have been used to indicate 'consistency' where an answer is obtained using a prior, but incorrect answer and **NC** if the answer is not consistent with wrong working.
- **CAO** is used when the 'correct answer only' is given and the assessment schedule indicates that more evidence was required.
- **#** may have been used when a correct answer is obtained but then further (unnecessary) working results in an incorrect final answer being offered.
- **RAWW** indicates right answer, wrong working.
- **R** for 'rounding error' and **PR** for 'premature rounding' resulting in a significant round-off error in the answer (if the question required evidence for rounding).
- **U** for incorrect or omitted units (if the question required evidence for units).
- **MEI** may have been used to indicate where a minor error has been made and ignored.