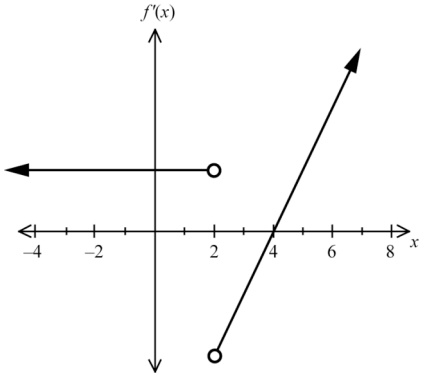
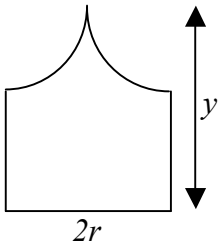
Assessment Schedule – 2007

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.	1a	$\frac{dy}{dx}=\frac{1}{4}(2x-7)^{\frac{-3}{4}}.2$ $=\frac{1}{2}(2x-7)^{\frac{-3}{4}}$	A1	Or equivalent	**Achievement:** FOUR of Code **A** including at least ONE of Code **A1** and ONE of Code **A2.**
		1b	$\frac{dy}{dx}=12e^{4x}+\frac{5}{5x+6}$	A1	Or equivalent	
		1c	$\frac{dy}{dx}=(x^2-1)\sec^2 x+\tan x.2x$	A1	Or equivalent	
		2	$\frac{dh}{dt}=\frac{5}{2}t^{\frac{-1}{2}}+\frac{15}{t+1}$ When $t=15$, $\frac{dh}{dt}=\frac{5}{2\sqrt{15}}+\frac{15}{16}$ $=1.6\ \text{m s}^{-1}$	A1 or A2	Must show derivative Or equivalent Units not required.	
		3	$\frac{dy}{dx}=3(x^2-3x)^2(2x-3)$ When $x=2$, $\frac{dy}{dx}=12$ Equation of tangent: $y+8=12(x-2)$ $y=12x-32$ or $12x-y-32=0$	A1 or A2	Must show $\frac{dy}{dx}$ Or equivalent	

	Achievement Criteria	Q.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH MERIT	Demonstrate knowledge of advanced concepts and techniques of differentiation and solve differentiation problems.	4	$2x+3-8y\frac{dy}{dx}=5\frac{dy}{dx}$ $2x+3=(8y+5)\frac{dy}{dx}$ $\frac{dy}{dx}=\frac{2x+3}{8y+5}$	A1 M1	Or equivalent.	**Merit:** Achievement **PLUS** THREE of Code **M** including at least ONE of code **M1** **and** ONE of code **M2** **OR** FOUR of Code **M**
		5		M1	Accept 4 of 5: • When x < 2, positive gradient horizontal line • When x = 2, not differentiable. Open circles. • When 2 < x < 4 negative gradient increasing. • When x = 4, zero gradient. • When x > 4, positive gradient increasing.	
		6	$h=45\tan\theta$ $\frac{dh}{d\theta}=45\sec^2\theta$ $\frac{dh}{dt}=-3$ $\frac{d\theta}{dt}=\frac{d\theta}{dh}\frac{dh}{dt}$ $=-\frac{\cos^2\theta}{15}$ When $\theta=\frac{\pi}{4}$, $\frac{d\theta}{dt}=-\frac{1}{30}$ rad s^{-1} θ is decreasing at $\frac{1}{30}$ radians per second	A1 M1 or A2 M2	Must show $\frac{d\theta}{dt}$ Accept $\frac{d\theta}{dt}=\pm0.033$ Or equivalent. 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.	7	 Perimeter of window: $2r + 2(y - r) + 2.\frac{1}{4}\pi 2r = 600$ $y = 300 - \frac{\pi}{2}r$ Area of window: $A = 2ry - \frac{1}{2}\pi r^2$ $= 600r - \frac{3\pi}{2}r^2$ $\frac{dA}{dr} = 600 - 3\pi r$ Maximum when $\frac{dA}{dr} = 0$ $r = \frac{600}{3\pi} = 63.66$ cm Max area = 19100 cm^2	A2 M2	Ignore a minor numerical error. Must show $\frac{dA}{dr}$ Or equivalent. Units not required.	**Merit:** Achievement **PLUS** THREE of Code **M** Including at least ONE of code **M1** and ONE of code **M2** **OR** FOUR of Code **M**

	Achievement Criteria	Q.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH EXCELLENCE	Solve more complex differentiation problem(s).	8	$\frac{dx}{dt} = 12t^2 \quad \frac{dy}{dt} = 6t - 7$ $\frac{dy}{dx} = \frac{6t-7}{12t^2}$ $= \frac{1}{2t} - \frac{7}{12t^2}$ $\frac{d^2y}{dx^2} = (-\frac{1}{2t^2} + \frac{14}{12t^3})\frac{1}{12t^2}$ $= \frac{7-3t}{72t^5}$ Concave up when $\frac{d^2y}{dx^2} > 0$ $\frac{7-3t}{72t^5} > 0$ $0 < t < 2\frac{1}{3}$	A1 M1 A2 M2 E	Must show $\frac{dy}{dx}$ Or equivalent Must show $\frac{d^2y}{dx^2}$ Or equivalent	**Excellence:** Merit **plus** Code **E**

Judgement Statement

Achievement	Achievement with Merit	Achievement with Excellence
Differentiate functions and use derivatives to solve problems. 4 × A *including* at least 1 × A1 *and* at least 1 × A2	Demonstrate knowledge of advanced concepts and techniques of differentiation and solve differentiation problems. **Achievement** *plus* 3 × M including at least 1 × M1 *and* 1 × M2 *or* 4 × M	Solve more complex differentiation problem(s). **Merit** *plus* 1 × 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 be 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.