JAMES RUSE AGRICULTURAL HIGH SCHOOL
YEAR 11 MATHEMATICS (2 UNIT)
PRELIMINARY EXAMINATION 2006

QUESTION 1 Marks

(a) Solve for x: $|5-2x| \geq 5$. 3

(b) Simplify $\dfrac{\log_2 16}{\log_2 8}$. 2

(c) Find the equation of the tangent to $y = \cos x$ at the point $\left(\dfrac{\pi}{2}, 0\right)$. 3

(d) Given that $x = \dfrac{\sqrt{5}-1}{2}$, find the value of $x + \dfrac{1}{x}$ in simplest form. 3

(e) Solve for x: $\sqrt{3}\sin x + \cos x = 0$, for $0° \leq x \leq 360°$. 2

(f) Simplify: $\tan(180° - A) \div \sin(180° + A) \times \sin(90° - A)$. 2

QUESTION 2 (START A NEW PAGE) Marks

(a) Differentiate with respect to x:

(i) $xe^{\sin x}$ 2

(ii) $\dfrac{1}{(5-3x)^6}$ 2

(iii) $\tan\left(x + \sqrt{x}\right)$ 2

(iv) $\dfrac{x}{\ln x}$ 2

(b) Solve for x: $(0.125)^x = \sqrt{0.5}$. 2

(c) The gradient of the curve $y = ax^2 + bx$ at the point $(2,4)$ is -8. Calculate the values of a and b. 3

(d) Find the value of k if $3x - 4y = 2$ is perpendicular to $5x + ky = 7$. 2

QUESTION 3 (START A NEW PAGE) Marks

(a) The equation of a parabola is $4y = 12 - 4x - x^2$.

(i) Find the coordinates of the focus and the equation of the directrix of the parabola. 3

(ii) Sketch the parabola showing the focus and the directrix. 2

(iii) For what values of x is $12 - 4x - x^2 < 0$ 1

(b) For what values of a will the quadratic expression $ax^2 + 5x + a$ be positive definite? 3

(c) If the roots of the quadratic equation $2x^2 - 5x + 12 = 0$ are $x = \alpha$ and $x = \beta$, find the value of

(i) $\alpha + \beta$. 1

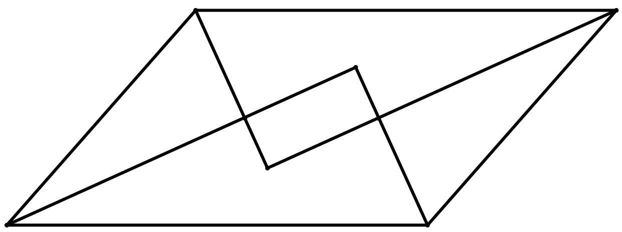
(ii) $(\alpha - \beta)^2$. 2

(d) Solve for x: $\log_3 x - \log_3(x - 4) = 2$. 3

QUESTION 4 (START A NEW PAGE) Marks

(a) Find the coordinates of the inflexion point on the curve $y = x^2 - \dfrac{2}{x}$, justifying your answer. 3

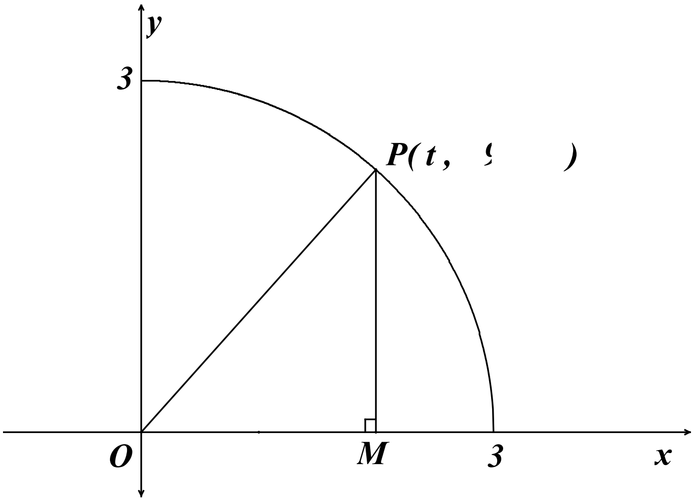
(b) The quadrilateral *PQRS* is a parallelogram with $SR \neq RQ$. The bisectors of its angles intersect at *A*, *B*, *C* and *D* as shown.



Copy or trace the diagram onto your answer page and prove that quadrilateral *ABCD* is a rectangle. 4

Question 4 (continued)

(c) The diagram shows the curve $y = \sqrt{9 - x^2}$ for $x \geq 0$. P is the point $\left(t, \sqrt{9 - t^2}\right)$ on the curve and M is the foot of the perpendicular drawn from P to the x-axis.



(i) Calculate the area bounded by the curve $y = \sqrt{9 - x^2}$ and the positive co-ordinate axes. 1

(ii) Write down an expression in terms of t for the area, A, of ΔOPM. 1

(iii) Find the co-ordinates of P which gives ΔOPM the maximum area. 4

(iv) Find the maximum area of ΔOPM. 1

(v) Find the ratio of the maximum area of ΔOPM to the area bounded by the curve and the positive co-ordinate axes calculated in (i). 1

END OF PAPER

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