Name:	
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# SYDNEY TECHNICAL HIGH SCHOOL



# HSC ASSESSMENT TASK 1

# DECEMBER 2006

## **MATHEMATICS**

Time Allowed:

### Instructions:

Write your name and class at the top of each page

70 minutes

- All necessary working must be shown. Marks may be deducted for careless or badly arranged work.
- Marks indicated are a guide only and may be varied if necessary.
- Start each question on a new page.
- Diagrams unless otherwise stated are not to scale.

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	**	TOTAL
/1	/1	. /1	1	17	/7	17	1,	/1	156

QUESTION 1 (7 Marks)	(MARK
a) Factorise $2x^2 + 5x - 3$	(1)
b) Solve $x^2 - 4x > 0$	(2)
Evaluate $\sum_{r=2}^{5} \frac{1}{r+1}$	(1)
d) Let $\alpha$ and $\beta$ be the roots of $x^2 - 3x - 7 = 0$ find	
i) $\alpha + \beta$	(1)
ii) <i>αβ</i>	(1)
e) Form a quadratic equation whose roots are $-2$ and 3	(1)
QUESTION 2 (7 Marks) (start a new page)	(MARKS)
(a) If $x = -2$ is a root of $4x^2 + x + k = 0$ , find $k$	(1)
b) Find the limiting sum of the geometric series	
$\frac{13}{5} + \frac{13}{25} + \frac{13}{125} + \dots$	(2)
c) For the sequence -8 , -1 , 6	
i) Find the 29 <sup>th</sup> term	(1)
ii) Find the sum of the first 29 terms	(1)
iii) Which term of the sequence has a valve of 167?	(2)
QUESTION 3 (7 Marks) (start a new page)	(MARKS)
a) i) Draw a neat sketch (using a ruler for the axes) of the parabola $x^2 = 8y$	(1)
ii) Find the co-ordinates of the focus	(1)
iii) Find the equation of the directrix	(1)
iv) Find the equation of the tangent to the parabola $x^2 = 8y$ that passes through	
the point (-8, 8)	(2)

b) In solving a quadratic equation a student wrote his solution as

$$x = \frac{4 \pm \sqrt{16 + 96}}{6} \tag{2}$$

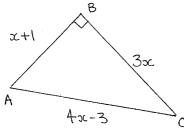
What was the original equation?

## QUESTION 4 (7 Marks) (start a new page)

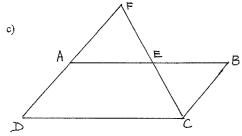
(MARKS)

(2)

a) Triangle ABC below has angle ABC equal to 90°. Find all possible value(s) for x.



b) How much will \$500 grow to at 12 % p.a. if compounded quarterly for 5 years (1



ABCD is a parallelogram AE=EB

DA produced intersects

CE produced at F

- i) Copy the diagram onto your answers sheet
- ii) Prove  $\triangle AFE \equiv \triangle BCE$

(2)

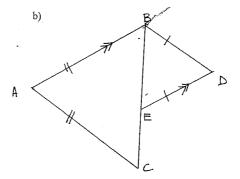
iii) Hence explain why DA = AF

(2)

### QUESTION 5 (7 Marks) (start a new page)

(MARKS)

a) For what values of k does the equation  $x^2 + kx + 3 - k = 0$  have real, different roots? (3)



Triangles ABC and BDE are isosceles AB=AC and BD=ED and AB || ED

- i) Copy the diagram onto your answer sheet.
- Fig. Prove  $\triangle ABC$  is similar to  $\triangle BDE$  (3)
- If BD = 5cm, BE = 4cm and AC = 6cm find the length of EC (1)

### QUESTION 6 (7 Marks) (start a new page)

(MARKS)

- a) Insert three numbers between 5 and 80 so as to form five numbers
   in a geometric sequence.
- b) The first n terms of an arithmetic sequence have a sum given by  $S_n = 25n 2n^2$ 
  - i) Find the first term and the second term (2)
  - ii) Find the common difference (1)
  - iii) Find the expression for the nth term (1)

# QUESTION 7 (7 Marks) (start a new page) (MARKS) a) A man places \$1500 at the beginning of each year into a superannuation fund, for 30 years. Interest on investments in the fund compounds at 12 % p.a. (1) Find the amount he has in the fund at the end of 30 years ii) If this amount in part i) is taken as a lump sum and taxed at the rate of 30 % for each dollar over \$50,000, how much will he receive after tax. (2)

b) For the parabola  $y = x^2 + 4x + 5$  find

i) the co-ordinates of the vertex (1)

(1) the co-ordinates of the focus

### QUESTION 8 (7 Marks) (start a new page)

(MARKS)

- a) A is the point (8,0) and 0 is the origin. P is the variable point (x, y)
  - i) If P moves so that PO = 3PA, show that the locus of P is given by

$$x^{2} + y^{2} = 9[(x-8)^{2} + y^{2}]$$
 (2)

- ii) Show that this locus is a circle by finding its centre and radius (2
- b) i) Find the sum of the geometric series

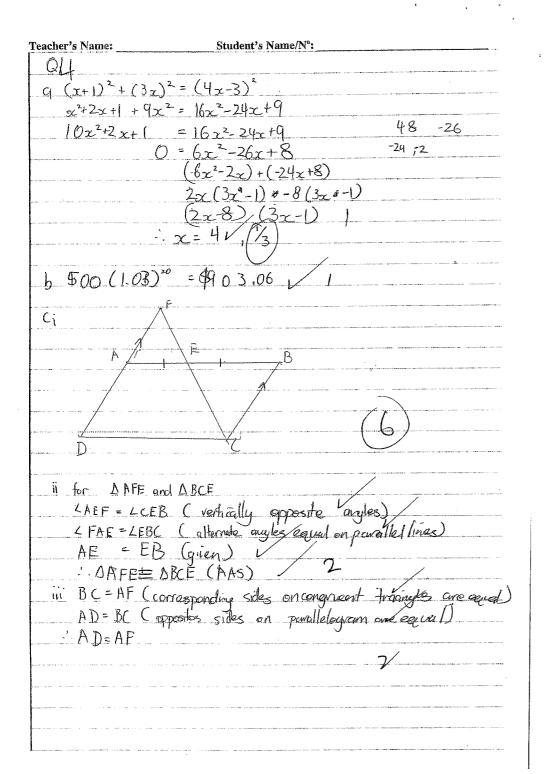
$$x^4 + x^3y + x^2y^2 + xy^3 + y^4 (2)$$

(i) Hence factorise 
$$x^5 - y^5$$

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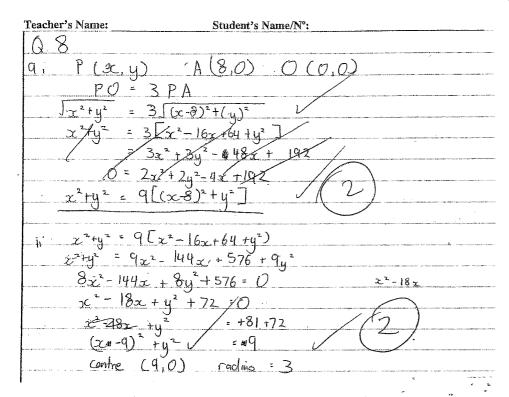
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(b) (i) 
$$\alpha = x^{\frac{4}{5}}$$
,  $r = \frac{y}{x}$ ,  $n = 5$   

$$S_{n} = \frac{\alpha(r^{n}-1)}{r-1}$$

$$S_{5} = \frac{x^{4}((\frac{y}{x})^{5}-1)}{\frac{y}{x}-1}$$

$$= x^{4}((\frac{y^{5}-x^{5}}{x^{5}}) \div ((\frac{y-x}{x}))$$

$$= \frac{y^{5}-x^{5}}{x} \times \frac{x}{y-x}$$

$$= \frac{y^{5}-x^{5}}{y-x} \quad \text{or} \quad \frac{x^{5}-y^{5}}{x^{5}-1}$$

(ii) Hence 
$$x^4 + x^3y + x^2y^2 + xy^3 + y^4 = \frac{x^5 - y^5}{x - y}$$
  

$$\therefore (x - y)(x^4 + x^3y + x^2y^2 + xy^3 + y^4) = x^5 - y^5$$