Outcome 1   Non-Right Angled Trigonometry   (20 Marks)
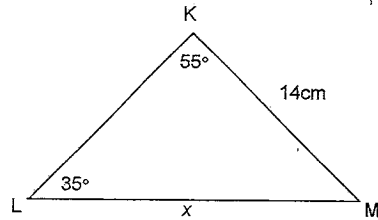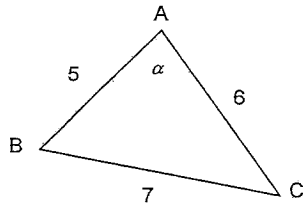
Section 1   Select the correct alternative A, B, C or D

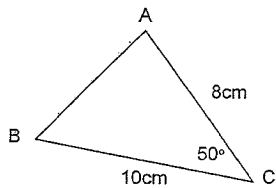1)   Which of the following statements is correct?   1 Mark

K
55°
14cm
35°
L   x   M

(A) $\dfrac{x}{\sin 55°} = \dfrac{14}{\sin 35°}$

(B) $\dfrac{x}{\sin 70°} = \dfrac{14}{\sin 35°}$

(C) $\dfrac{x}{\sin 70°} = \dfrac{14}{\sin 50°}$

(D) $\dfrac{x}{\sin 55°} = \dfrac{14}{\sin 50°}$

2)   Using the Cosine Rule, $\cos \alpha =$ 1 Mark

A
5   α
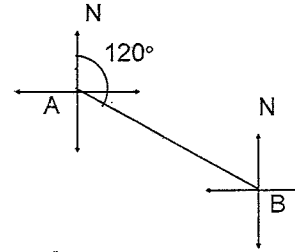B   6
7   C

(A) $\dfrac{19}{35}$ (B) $\dfrac{1}{5}$ (C) $\dfrac{2}{5}$ (D) $\dfrac{5}{7}$

3)   The area of the triangle ABC is closest to   1 Mark

A
8cm
B
50°
10cm   C

(A) $30\cdot6\,\text{cm}^2$ (B) $51.4\,\text{cm}^2$ (C) $61\cdot3\,\text{cm}^2$ (D) $25\cdot7\,\text{cm}^2$

4)   The true bearing of A from B is   1 Mark

N
120°
A   N
B

(A) 300°T   (B) 290°T   (C) 120°T   (D) 60°T

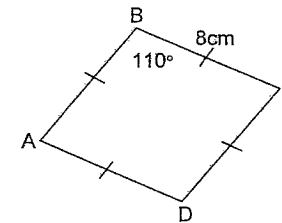### Section 2   Show all working

5)   (i)   Find the value of $<PQR\ (\theta)$
     (ii)   Hence find the obtuse angle α, correct to the nearest minute.
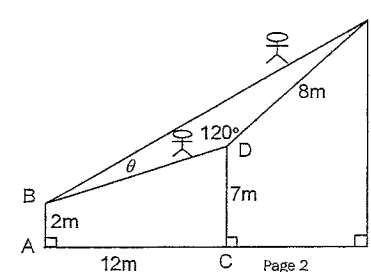
P
7cm α 10cm
Q θ 34°   R
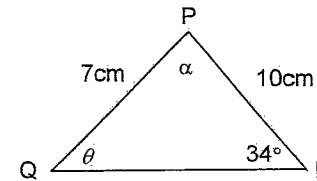
                                                                3 Marks

6)   ABCD is a rhombus. Find its area correct to 2 decimal places.   2 Marks

B
110°   8cm
A   C
D

7)   A tight rope walker, Ben, walks from B to F directly up the longest wire. His
     assistant, Kate walks between the same points using wires BD and DF.

F
8m
120°   D
θ
B   7m
2m
A   E
12m   C

(i)   Show the distance Kate walks from B to D is 13m.   1 Mark

(ii) How much further does Kate walk than Ben?
      Answer correct to the nearest centimetre.   3 Marks

(iii) Find the angle, θ between the wires BD and BF.
      Answer correct to the nearest minute.   2 Marks

Section 3   Show all working

8)   From Pete's home, H, the Rugby Club, C, is on a bearing of 035°T and
     630m away while the beach, B, is on a bearing of 330°T and 400m away.

(i)   Draw a diagram showing **ALL** this information.   1 Mark

(ii) Find the distance of the beach, B, from the Rugby Club, C
      Answer correct to the nearest metre.   2 Marks

(iii) Find the bearing of the Rugby Club, C, from the beach B
      Answer correct to the nearest degree.   2 Marks

Outcome 2   Probability   (11 Marks)

START A NEW PAGE

Section 1   Select the correct alternative A, B, C or D

1)   A letter is chosen at random from the word NEWINGTON. The probability
     that it will be an N is

     (A) $\dfrac{1}{9}$ (B) $\dfrac{2}{7}$ (C) $\dfrac{1}{3}$ (D) $\dfrac{3}{6}$ 1 Mark

2)   John is three times more likely to win a race more than Rob. How many times
     would you expect Rob to win if they race thirty-six times?

     (A) 9   (B) 12   (C) 18   (D) 27   1 Mark

3)   A coin can land on either heads or tails. When two coins are tossed the chance
     of getting two tails is

     (A) $\dfrac{1}{2}$ (B) $\dfrac{1}{3}$ (C) $\dfrac{1}{4}$ (D) 2   1 Mark

Section 2   Show all working

4)   A card is drawn at random from a normal pack of fifty two cards. Find the
     probability that the card is

(i)   A spade   1 Mark

(ii) A diamond or an ace   1 Mark

5)   A three digit number is formed using the digits 3, 6, 5 without replacement.

(i)   Use a tree diagram to list the sample space.   1 Mark

(ii) What is the probability that the number is divisible by 5?   1 Mark

6)   Two dice are thrown. Find the probability that:

(i)   The sum of the two numbers is 9.   1 Mark

(ii) The two numbers are not equal.   1 Mark

Section 3   Show all working

7)   In a class of thirty-six pupils, twenty-six play cricket, twenty-four play
     football and eighteen play both cricket and football. What is the probability
     that a pupil chosen at random plays neither cricket or football?   2 Marks

Outcome 3   Data   (9 Marks)

START A NEW PAGE

Section 1   Select the correct alternative A, B, C or D

1) The square represents a missing digit in the stem and leaf plot.

Given the median is 45, what does ☐ represent

STEM		LEAF
3		7 8 9
4		☐ 8
5		1 3 7

(A)   0   (B)   2   (C)   4   (D)   5   1 Mark

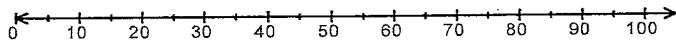2) The total of four scores is twenty. A score is added and the new mean is five.
The score that was added was

(A)   4   (B)   4·5   (C)   5   (D)   5·5   1 Mark

3) A normal distribution has a mean of 70 and a standard deviation of 5.
What percentage of scores are between 65 and 75?

(A)   50%   (B)   79%   (C)   68%   (D)   95   1 Mark

Section 2   Show all working

4) Copy the diagram

Draw a box and whisker plot given the following information.

Highest score = 80
Lowest score = 25
Lower quartile = 50
Upper quartile = 70
Median = 65

           1 Mark

5) Given the following scores 61, 52, 57, 48, 65, 55 find the standard deviation correct to one decimal place.

           1 Mark

6) Find the inter-quartile range of the following scores.

9, 1, 11, 2, 10, 11, 2, 10, 5, 7, 11, 11.

           1 Mark

Section 3   Show all working

7) The following statistics were obtained from a Mathematics and English test

	$\bar{x}$	σ	Brian's Mark
Maths	60	9	40
English	50	13	40

(i) Brian said "I scored better in Mathematics". Do you agree?
Use the information in the table to justify your response.   2 Marks

(ii) The teacher had forgotten to include the mark of 59 when calculating the statistics for Mathematics. In what way would the <u>mean</u> and <u>standard deviation</u> for Mathematics be affected once the score was included?   1 Mark
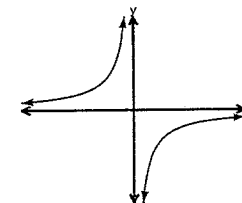
Outcome 4   Graphs   (20 Marks)

START A NEW PAGE

Section 1   Select the correct alternative A, B, C or D

1) Select the equation which matches the graph below.
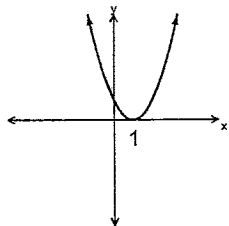

(A) $xy = 4$ (B) $y = \dfrac{-4}{x}$ (C) $x^2 + y^2 = 4$ (D) $y = 4x$ 1 Mark
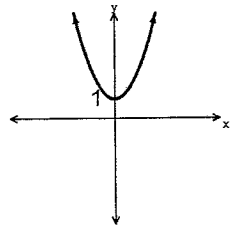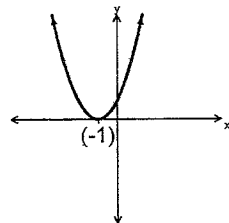
2) The graph that represents $y=(x+1)^2$ is   1 Mark

(A)
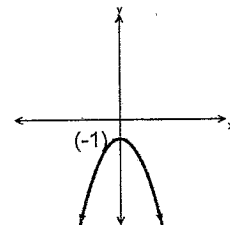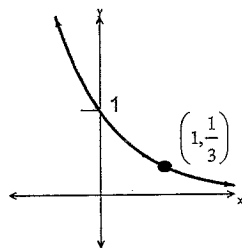

(B)

(C)

(D)

3) The equation of the graph below is

(A) $y=3^x$ (B) $y=-3^x$ (C) $y=3^{-x}$ (D) $y=-3^{-x}$ 1 Mark

Section 2 Show all working

4) A parabola has the equation $y=x^2-7x+10$.

  (i) Find the y-intercept.   1 Mark

  (ii) Find the x-intercepts.   1 Mark

  (iii) Find the equation of the axis of symmetry.   1 Mark

  (iv) Find the co-ordinates of the vertex   1 Mark

  (v) Find the minimum value.   1 Mark

  (vi) Sketch the curve showing all the above details.   1 Mark

5) Sketch the following curves, showing all essential features.

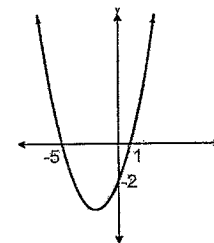 (i) $x^2+y^2=4$ 2 Marks

  (ii) $y=\dfrac{1}{x+4}$ 2 Marks

6) Explain what happens to the curve $y=x^3$ when the following translations are performed.

  (i) $y=x^3-1$ 1 Mark
  (ii) $y=(x-1)^3$ 1 Mark

Section 3 Show all working

7) Use the sketch to find the equation of the following parabola

           3 Marks

8) Find the centre and radius of the semi-circle $y=-\sqrt{28-x^2}$ 2 Marks
  Give your answer in simplest form.

Outcome 5   **Polynomials**   **(20 Marks)**

START A NEW PAGE

Section 1   Select the correct alternative A, B, C or D

1)   Which of the following is a polynomial?   1 Mark

    (A) $\dfrac{9x^3 + x^2 + x^2}{x}$ (B) $4x + 2\sqrt{x}$

    (C) $x^2 - 2x + 3^x$ (D) $\dfrac{5}{x^2} + \dfrac{2}{x^3} + x$

2)   Given $P(x) = 3x - 6x^4 - 5 + 2x^2$, the leading term is: 1 Mark

    (A) $3x$ (B) $-6x^4$

    (C) 3 (D) -5

3)   Which of the following is a factor of $x^3 - x^2 - 10x - 8$ 1 Mark

    (A) $(x-1)$ (B) $(x-2)$ (C) $(x+4)$ (D) $(x+1)$

Section 2   Show all working

4)   Find the value of k if $2x^3 + 6x^2 - 3x + k$ is divided by $(x-1)$ and
     the remainder is 6.   1 Mark

5)   If $P(x) = x^2 - 16$, solve $P(x) = 0$ 1 Mark

6)   Given $P(x) = 2x^4 - 17x^2 - 3$ and $Q(x) = x^2 + 4x + 3$
     Find $P(x) \div Q(x)$ and write your answer in the form $P(x) = A(x)Q(x) + R(x)$ 2 Marks
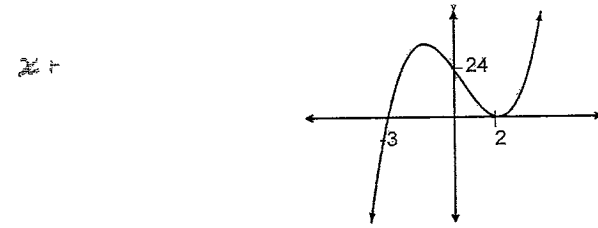
7)   Sketch the following showing all the intercepts.

     (i) $y = x(x-3)(x+3)$ 2 Marks

     (ii) $y = (x-2)^2(x+1)^3$ 2 Marks

8)   Solve $x^3 + 2x^2 - 13x + 10 = 0$ 4 Marks

Section 3   Show all working

9)   Find the equation of this polynomial $P(x)$ of degree 3. Leave your answer in factorised form.

           2 Marks

10)   A polynomial is given by $P(x) = x^3 + ax^2 + bx - 18$. Find a and b if $(x+2)$
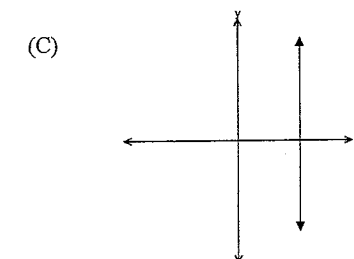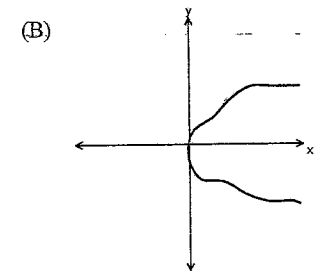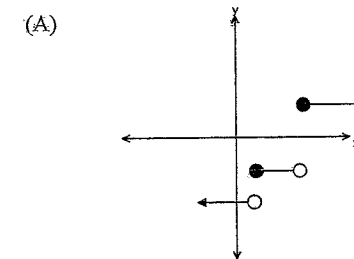   is a factor and -24 is the remainder when divided by $(x-1)$ 2 Marks

Outcome 6   **Functions and Logarithms**   **(20 Marks)**

START A NEW PAGE

Section 1   Select the correct alternative A, B, C or D

1)   Which of the following are functions?   1 Mark

   (A)   (B)

   (C)   (D)

x	2	3	4	1
$f(x)$	5	7	9	5

2)   Given $16 = 4^2$, which of the following are true?   1 Mark

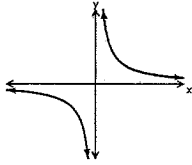   (A) $\log_4 16 = 2$ (B) $\log_2 4 = 16$

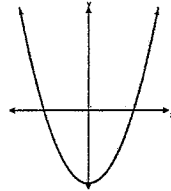   (C) $\log_{16} 2 = 4$ (D) $\log_{16} 4 = 2$

3)   Which of the following graphs represent functions whose inverse is a function   1 Mark
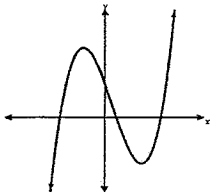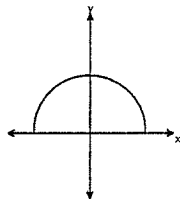
(A)

(B)

(C)

(D)

Section 2   Show all working

4)   Given $f(x) = \dfrac{x+1}{x-1}$

    (i)   Evaluate $f\left(\dfrac{1}{2}\right)$ 1 Mark

    (ii)   Solve $f(x) = \dfrac{1}{2}$ 1 Mark

5)   Evaluate $27^x = \dfrac{1}{9}$ 1 Mark

6)   Simplify   (i) $\dfrac{\log_a 16}{\log_a 2}$ 1 Mark

                 (ii) $5\log_8 2 + \dfrac{1}{2}\log_8 4$ 2 Marks

7)   Given $\log 2 = 0.3010$ and $\log 3 = 0.4771$

    Evaluate   (i) $\log_{10} 6$ 1 Mark

                 (ii) $\log 1.5$ 1 Mark

                 (iii) $\log 24$ 2 Marks

8)   Solve   (i) $2^{x-3} = 47$ 2 Marks

              (ii) $\log_x \dfrac{1}{4} = 2$ 1 Mark

Section 3   Show all working

9)   Solve $\log x + \log (x-2) = 3\log 2$ 3 Marks

END OF TEST

SOLUTIONS [Yr-10 Newington 2006]

OUTCOME 1 — Section 1 —

1) (A) 2) B 3) A 4) A

— Section 2 —

5) $\frac{\sin\theta}{10} = \frac{\sin 34}{7} \Rightarrow \theta = 53°1'$

6) Area $= 2 \times [\frac{1}{2}ab\sin\hat{c}] = 8 \times 8 \sin 110° = 60.1$
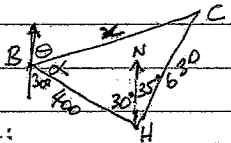
7) i) Pythagoras $5^2 + 12^2 = BD^2 \Rightarrow BD = 13$
   ∴ Kate walks $13 + 8 = 21$ metres

   ii) using Cosine Rule!
   $BF^2 = 8^2 + 13^2 - 2 \times 8 \times 13 \times \cos 120°$
   $BF = 18.36m \Rightarrow 2.64$ metres further

   iii) $\frac{\sin\theta}{8} = \frac{\sin 120°}{18.36} \Rightarrow \theta = 22°10'$

8) i) →
   ii) Use cosine Rule:
   $x^2 = 400^2 + 630^2 - 2 \times 400 \times 630 \times \cos 65°$
   $x = 586.43 \approx 586$ metres

   iii) Find θ (see diagram)
   First find α (∠CBH)
   $\frac{\sin\alpha}{630} = \frac{\sin 65}{586.43} \Rightarrow \alpha = 76°49'$
   $\approx 77°$

   ∴ bearing is $150 - 77 = 073°$

OUTCOME 2 — Section 1 —

1) C 2) A 3) C

— Section 2 —

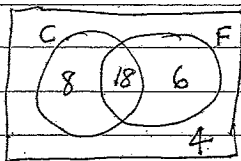4) i) $\frac{1}{4}$ ii) $\frac{13+3}{52} = \frac{4}{13}$

5) i) 356, 365, 536, 563, 635, 653
   ii) $\frac{2}{6} = \frac{1}{3}$

6) i) $\frac{4}{36} = \frac{1}{9}$ ii) $\frac{30}{36} = \frac{5}{6}$

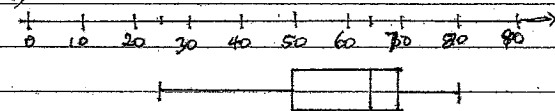— Section 3 —

7) $P = \frac{4}{36} = \frac{1}{9}$

OUTCOME 3 — Section 1 —

1) B 2) C 3) C

— Section 2 —

4)

5) $\sigma_n \approx 5.6$

6) I.Q.R. $= 11 - 3\frac{1}{2} = 7.5$

— Section 3 —

7) i) Maths was $\frac{20}{9} \approx 2.2 \sigma$ below $\bar{x}$
   English was $\frac{10}{13} \approx 0.8 \sigma$ below $\bar{x}$
   No English was not as BAD as maths

   ii) Both would become smaller.

OUTCOME 4 — Section 1 —
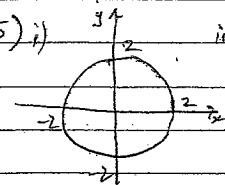
1) B 2) C 3) C

— Section 2 —

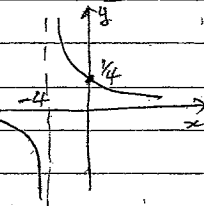4) i) (0, 10) ii) (3, 0) & (4, 0)
   iii) $x = 3.5$ iv) V = (3.5, -2.25)
   v) $y_{min} = -2\frac{1}{4}$ vi) Check,
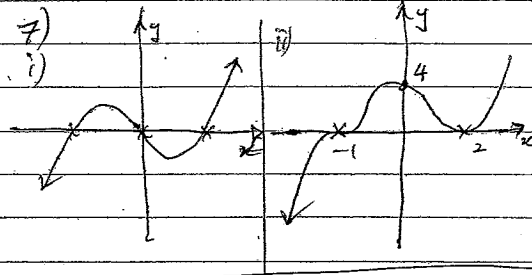
[Outcome 4 — Section 2 — con't]

5) i)
ii)

6) i) Moves DOWN 1
   ii) Moves RIGHT 1

— Section 3 —

7) $y = k(x+5)(x-1)$ ←sub (0,-2)
   $-2 = k(5)(-1) \Rightarrow k = \frac{2}{5}$
   ∴ Equation $y = \frac{2}{5}(x+5)(x-1)$

8) $x^2 + y^2 = 28$ C = (0,0) R = $4\sqrt{7}$

OUTCOME 5 — Section 1 —

1) A 2) B 3) D

— Section 2 —

4) $P(1) = 6 \Rightarrow k = 1$

5) $\Rightarrow x^2 - 16 = 0 \Rightarrow x = \pm 4$

6)
$$\begin{array}{r} 2x^2 - 8x + 9 \\ x^2+4x+3 \overline{)2x^4 + 0x^3 - 17x^2 + 0.x - 3} \end{array}$$
Remainder $60x - 30$
∴ $P(x) = (x^2+4x+3)(2x^2-8x+9) + 60x - 30$

8) i) 8.5546 ii) $x = \frac{1}{2}$

9) $\log(x^2 - 2x) = \log 8$
   $x^2 - 2x - 8 = 0$ $x = 4$ or -2

7)
i)

8) $P(1) = 0 \Rightarrow (x-1)$ is a factor
$$\begin{array}{r} x^2 + 3x - 10 \\ x-1 \overline{)x^3 + 2x^2 - 13x + 10} \end{array}$$
∴ $P(x) = (x-1)(x+5)(x-2)$

9) $y = k(x+3)(x-2)^2$ ←sub (0,24)
   $24 = k(3)(2)^2 \Rightarrow k = 2$
   ∴ $P(x) = 2(x+3)(x-2)^2$

10) $P(x) = x^3 + ax^2 + bx - 18$
   $P(-2) = -8 + 4a - 2b - 18 = 0$ (✳)
   $P(1) = 1 + a + b - 18 = -24$ (✳✳)
   $\Rightarrow 4a - 2b = 26$ ⎫ $4a - 2b = 26$
   $a + b = -7$ ⎭ $2a + 2b = -14$
   $\Rightarrow a = 2$ $b = -9$.

OUTCOME 6 — Section 1 —

1) A and D 2) A 3) A

— Section 2 —

4) i) -3 ii) -3

5) $3^{3x} = 3^{-2} \Rightarrow x = -\frac{2}{3}$

6) i) $\log_2 16 = 4$ ii) $\log_8(2^5 \times \sqrt{4}) = 2$

7) i) 0.7781 ii) 0.1761 iii) 1.3801