Section One: Multiple Choice

5 marks
Attempt Questions 1-5
Allow about 10 minutes for this section
Write your answer on the paper provided.

1. What are the solutions to $3x^2 - 7x - 1 = 0$?

(A) $x = \dfrac{-7 \pm \sqrt{37}}{6}$

(B) $x = \dfrac{-7 \pm \sqrt{61}}{6}$

(C) $x = \dfrac{7 \pm \sqrt{37}}{6}$

(D) $x = \dfrac{7 \pm \sqrt{61}}{6}$.

2. Which of the following is irrational?

(A) $\sqrt{289}$

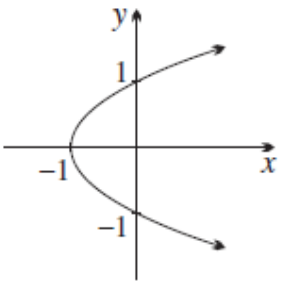
(B) $\sqrt[3]{27}$

(C) $\sqrt{11}$

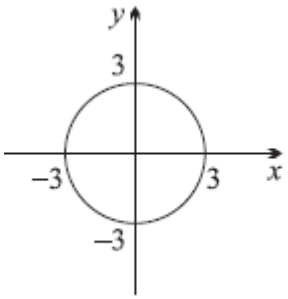
(D) $\dfrac{3}{7}$.

3. Which of the following is function?

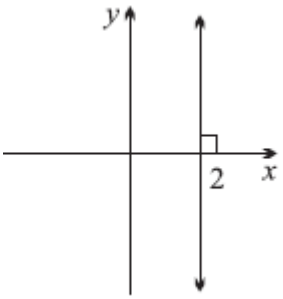
(A)



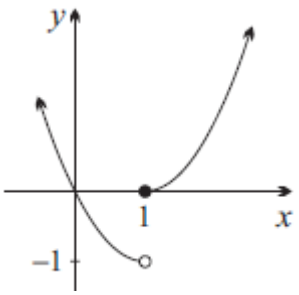
(B)



(C)



(D)



4. Which of the following is true about the function $f(x) = 2^x + 2^{-x}$

(A) Even function
(B) Odd function
(C) Zero function
(D) Neither odd or even function.

5. Simplify $\sin\theta \sec\theta$.

(A) $\cos ec\ \theta$

(B) $\sin^2\theta$

(C) $\tan\theta$

(D) $\cot\theta$.

Section Two: Extended Response

Attempt Questions 1-5
Write your answer on the paper provided.
Show all working.

Question One: Methods in Algebra (13 Marks) — Marks

a) Expand and simplify: $3(2x-1)-3(x+5)$. **2**

b) Fully factorise: $x^3+5x^2-9x-45$. **2**

c) Express $\frac{2x-3}{6}-\frac{x-7}{15}$ as a single algebraic fraction. **3**

d) Solve the equation : $\frac{x-2}{x+2}=2-x$. **3**

e) Fully simplify $\frac{x^3-64}{4-x}\div\frac{x^2+4x+16}{5}$. **3**

Question Two: Numbers and Surds (13 Marks) **Marks**
Start a new page

a) Fully simplify the following expressions:

i) $\sqrt{27} \times \frac{1}{3}\sqrt{3}$ **2**

ii) $(2\sqrt{5}+\sqrt{3})(7\sqrt{3}+\sqrt{5})$ **2**

iii) $\sqrt{x^3} + \sqrt{x} - \sqrt{4x}$. **2**

b) Express $0.2\dot{7}$ as a fraction in its simplest form without the use of a calculator. **2**

c) Simplify the following by rationalising the denominator $\frac{\sqrt{5}}{4\sqrt{5}+7}$. **3**

d) Given that a, b, c and d are integers, with b and d non-zero, **2**
simplify the average of $\frac{a}{b}$ and $\frac{c}{d}$.

Question Three: Functions and Graphs (13 Marks) **Mark**
Start a new page

a) If $f(x) = x^2 - 3x - 40$ find $f(5) + f(-5)$ **2**

b) Draw separate neat sketches, labelling significant features in the following:

i) $xy = 3$ **2**

ii) $y = x^2 + 3x - 10$. **2**

c) State the domain and range for b) i) and b) ii). **4**

d) A function is defined by the following: **3**

$$f(x) = \begin{cases} 4 \text{ for } x \le -3 \\ \sqrt{9 - x^2} \text{ for } -3 < x < 3 \\ x \text{ for } x \ge 3. \end{cases}$$

Copy and complete the table of values for $f(x)$, then sketch its graph.

x	-4	-3		-2	-1	0	1	2		3	4
y											

Question Four: Graphs and Inequations (13 Marks) **Marks**
Start a new page

a) Evaluate $\left|(-3)^2 - 7 \times 2\right|$. **1**

b) Solve for x given the inequation $19 < 7x + 5 < 75$. **2**

c) Solve $|2x + 1| \leq 9$. **2**

d) Solve the inequality $x(x+7)(5-x) < 0$. **3**

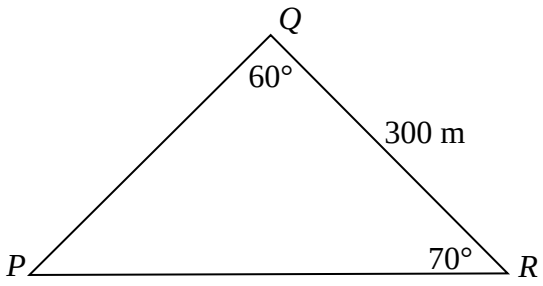
e) On a number plane, graph the following regions: **5**
$(x-1)^2 + y^2 \leq 16$ and $x - y + 3 \geq 0$

And shade the intersection of the regions.

Question Five: Trigonometry (13 Marks) **Marks**
Start a new page

a) If $0° \le \theta \le 360°$ find the values of θ given $\sec\theta = \frac{2}{\sqrt{3}}$ **3**

b) In the diagram below, use the Sine rule to find the length of PQ to the nearest metre. **3**



NOT TO SCALE

c) Given that the sides of a non right angled triangle are 6 cm, 11 cm and 15 cm:

i) Show that the smallest angle in the triangle is 20 ° to the nearest degrees. **2**

ii) Find the area of the triangle, give your answer to 1 decimal place. **2**

d) Prove that $\frac{1-\tan^2\theta}{1+\tan^2\theta} = \cos^2\theta - \sin^2\theta$. **3**

END OF EXAMINATION

Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
Year 11 - 2unit Mathematics Half Yearly Examination solutions 2015. Multiple Choice Q1. $a=3 \quad b=-7 \quad c=-1$ $x = \frac{--7 \pm \sqrt{(-7)^2-(4\times3\times-1)}}{2\times3}$ $x = \frac{7 \pm \sqrt{49--12}}{6}$ $x = \frac{7 \pm \sqrt{61}}{6}$ (D) Q2. Rational numbers can be expressed as a fraction. $\sqrt{289} = \frac{17}{1} \qquad 3\sqrt{27} = \frac{3}{1}$ $\therefore \sqrt{11}$ is the only value which can not be expressed as a fraction (C) Q3 Use the vertical line test A function has one y value for every x value. (D)	Take care with negative numbers

Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
Q4. $f(-x) = 2^{-x} + 2^{--x}$ $= 2^{-x} + 2^{x}$ $= f(x)$ When $f(x) = f(-x)$ it is an even function (A)	
Q5 $\sin\theta \times \frac{1}{\cos\theta} = \frac{\sin\theta}{\cos\theta} = \tan\theta$ (C)	The multiple choice questions were generally answered very well by students.
Extended Response Question One.	Question One is Reference to Ch1 of textbook.
a) $3(2x-1) - 3(x+5)$ $= 6x - 3 - 3x - 15$ ① $= 3x - 18$ ①	
b) $x^3 + 5x^2 - 9x - 45$ $x^2(x+5) - 9(x+5)$ $(x^2-9)(x+5)$ ① $(x+3)(x-3)(x+5)$ ①	Recognise Grouping and difference of 2 squares.

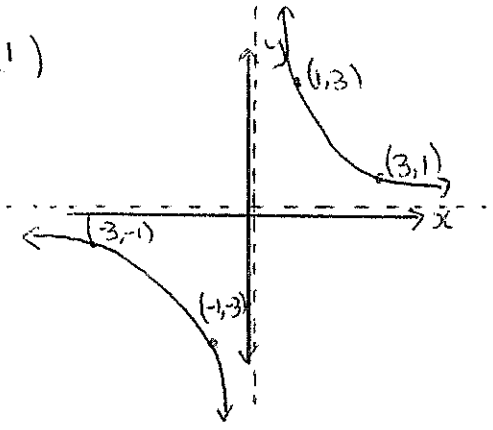
Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
c) $\frac{2x-3}{6} - \frac{x-7}{15}$ $= \frac{5(2x-3)-2(x-7)}{30}$ ① $= \frac{10x-15-2x+14}{30}$ ① $= \frac{8x-1}{30}$ ①	Some students failed to successfully change the fractions to have a LCD of 30. 'ect' marks awarded if correct simplifying after failed attempt at changing fractions.
d) $\frac{x-2}{x+2} = \frac{2-x}{1}$ $x \neq -2$ $x-2 = (2-x)(x+2)$ ① $x-2 = 4-x^2$ $x^2+x-6=0$ ① $(x+3)(x-2)=0$ $x=-3 \quad x=2$ ①	Recognise $(2-x)(x+2)$ $= (2-x)(2+x)$ Difference of 2 squares. some students struggled to get to this step by eliminating the $x+2$ denominator from the equation.
e) ① $\frac{(x-4)(x^2+4x+16)}{(4-x)} \div \frac{(x^2+4x+16)}{5}$ $= \frac{(x-4)(x^2+4x+16)}{(4-x)} \times$ ① $\frac{5}{(x^2+4x+16)}$ $= -1 \times 5$ $= -5$ ①	since $(4-x) = -1(x-4)$ some students forgot diff. 2 cubes factorisation.

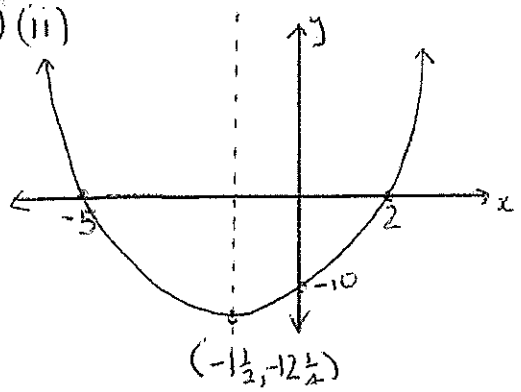
Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
Extended Response Question Two.	
a) (i) $\sqrt{27} \times \frac{1}{3}\sqrt{3}$	
$= 3\sqrt{3} \times \frac{1}{3}\sqrt{3}$ ①	ok ✓
$= 3$ ①	
(ii) F. O. I. L	
$14\sqrt{15} + 10 + 21 + \sqrt{15}$ ①	generally ok ✓
$15\sqrt{15} + 31$ ①	
(iii) $x\sqrt{x} + \sqrt{x} - 2\sqrt{x}$ ①	
$= \sqrt{x}(x-1)$ ①	many didn't factorise
b) Let $x = 0.277777\ldots$	
$10x = 2.77777\ldots$	
$100x = 27.77777\ldots$ ①	
$90x = 25$	some use their calculator! ☺ works
$x = \frac{25}{90} = \frac{5}{18}$ ①	
c) $\frac{\sqrt{5}}{4\sqrt{5}+7} \times \frac{4\sqrt{5}-7}{4\sqrt{5}-7}$ ①	some x by $4\sqrt{5}+7$ and some left out +
$\frac{20-7\sqrt{5}}{80-49}$ ① $= \frac{20-7\sqrt{5}}{31}$ ①	

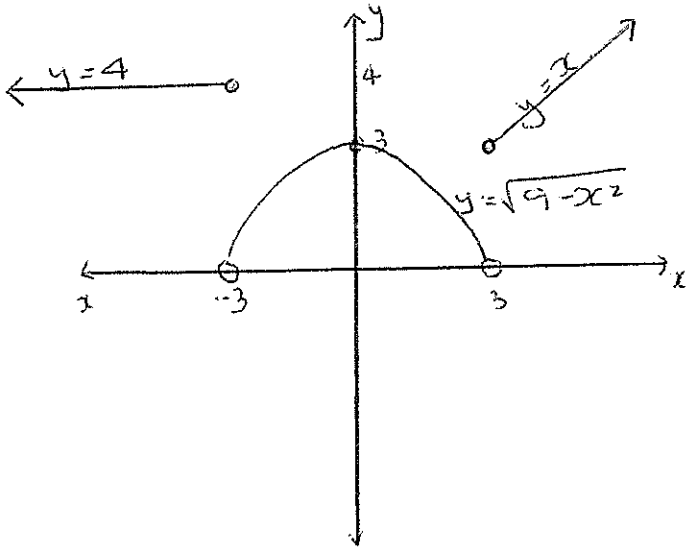
Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
d) $\dfrac{\dfrac{a}{b}+\dfrac{c}{d}}{2}$ $\dfrac{\dfrac{ad+bc}{bd}}{2}$ $\dfrac{ad+bc}{2bd}$	Many didn't attempt this question.
Extend Response Question 3	
a) $f(5) = 5^2-3(5)-40 = -30$ $f(-5) = (-5)^2-3(-5)-40 = 0$ ① $f(5)+f(-5) = -30$ ①	✓
b) (i) 	• many omitted asymptotes • very poor sketch

Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
b) (ii)  $y=(x+5)(x-2)$ (2)	• poor sketch need a single smooth curve • vertex not shown.
c) b(i) domain: all real x except when $x=0$ (1) range: all real y except when $y=0$ (1)	omitted $x \neq 0$ $y \neq 0$.
b(ii) domain: all real x (1) range: all real $y \geq -12\frac{1}{4}$ (1)	
d)	

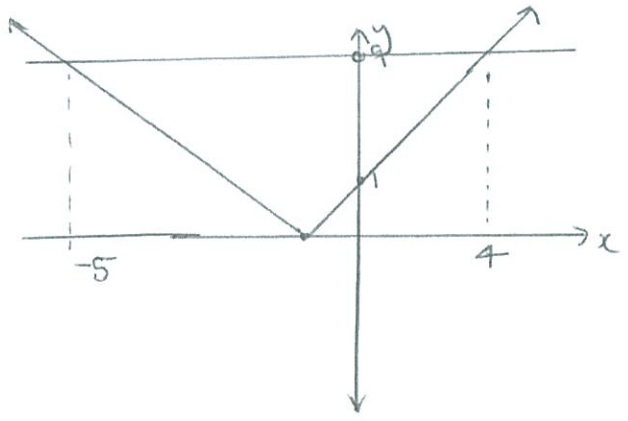
x	-4	-3	-2	-1	0	1	2	3	4
y	4	4	$\sqrt{5}$	$\sqrt{8}$	3	$\sqrt{8}$	$\sqrt{5}$	3	4



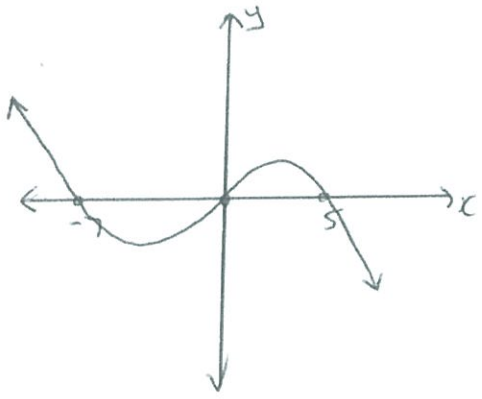
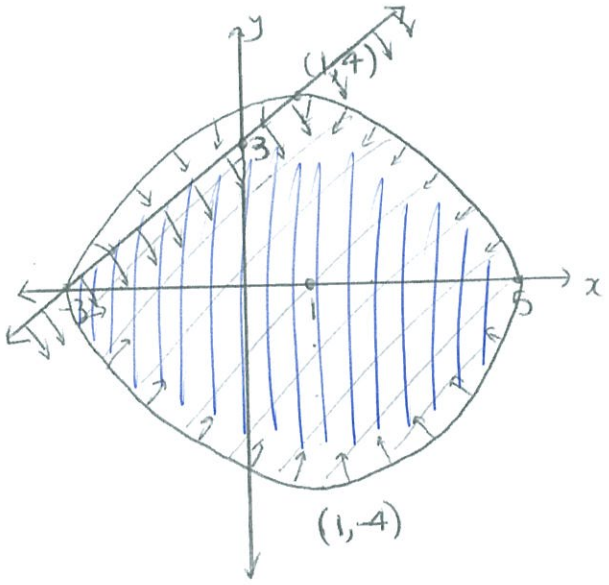
very poorly drawn.

Suggested Solutions, Marking Scheme and Markers' comments

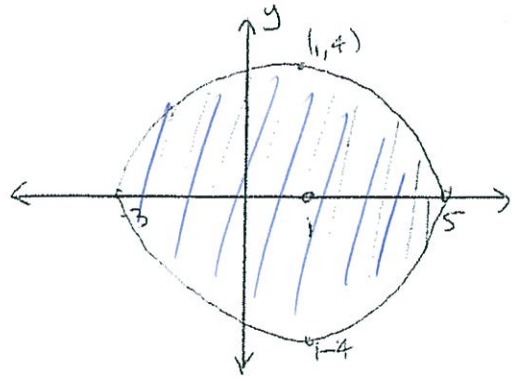
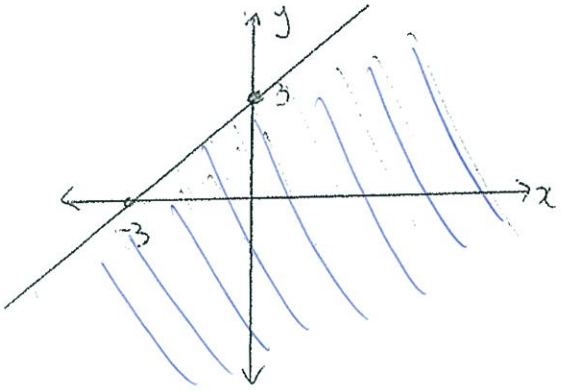
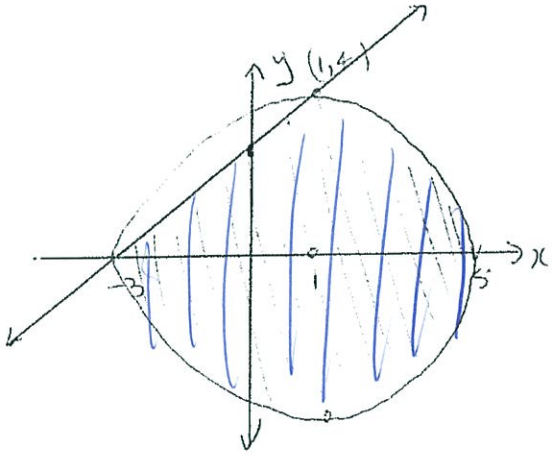
Suggested solution(s)	comments
Extended Response Question Four	
a) $\|9-14\| = \|-5\| = 5$ ①	only one answer = 5 |5| and -5 was NOT correct and written in addition to 5 meant no mark.
b) $19 < 7x+5 < 75$ $14 < 7x < 70$ ① subtract 5 $2 < x < 10$ ① divide 7	
c) $\|2x+1\| \leq 9$ $2x+1 \leq 9$ $\quad 2x+1 \geqslant -9$ $2x \leq 8$ $\quad 2x \geqslant -10$ $x \leq 4$ $\quad x \geqslant -5$ ① $-5 \leqslant x \leqslant 4$ ① check solution makes sense.	often only one solution was given.



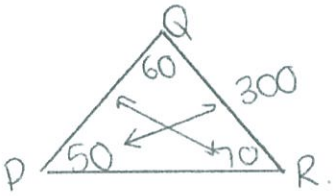
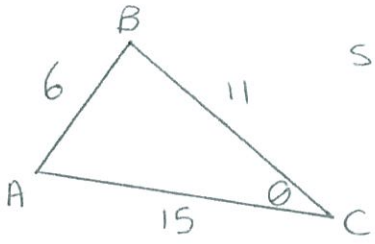
Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
d) $x(x+7)(5-x) < 0$ zeroes occur when $x=0$ $x=-7$ $x=5$ When $x \to \infty$ $y \to -\infty$  below y-axis $-7 < x < 0$ $x > 5$	1mark for (3 value $x=0$ $x=-7$ $x=5$ 1mark for graph/other. If graphed incorrectly e.c.f was awarded for final mark.
e)  2marks for graph of circle and correct region. 2marks for graph of line and correct region 1 mark for correct intersection.	Many students did not test a point and shaded the incorrect region (see over page)

Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
(e)  (2)  (2)  (1)	

Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
Question Five. a) $\frac{1}{\cos\theta} = \sec\theta$ S | A ✓ T | C ✓ $\therefore \cos\theta = \frac{\sqrt{3}}{2}$ ① $\theta = 30$ ① $\quad \theta = 330$ ① b)  $\angle QPR = 50°$ ① $\frac{PQ}{\sin 70} = \frac{300}{\sin 50}$ $PQ = \frac{300\sin 70}{\sin 50} = 368\ m$ c)  smallest angle is opposite smallest side $\cos\theta = \frac{15^2 + 11^2 - 6^2}{2\times 15\times 11}$ ① $\quad \cos^{-1}(ANS)$ (shift cos) $\theta = 20°$ ①	Good. Must use Sine Rule.

Suggested Solutions, Marking Scheme and Markers' comments

Suggested solution(s)	comments
C (ii) Area $= \frac{1}{2}ab\sin C$ Area $= \frac{1}{2} \times 11 \times 15 \times \sin 20$ Area $= 28.2\,cm^2$.	There is NO Right Angle in the triangle.
d) LHS $= \dfrac{1-\tan^2\theta}{1+\tan^2\theta}$ since $\tan^2\theta + 1 = \sec^2\theta$ LHS $= \dfrac{1-\tan^2\theta}{\sec^2\theta}$ ① $= \dfrac{1}{\sec^2\theta} - \dfrac{\tan^2\theta}{\sec^2\theta}$ $= \cos^2\theta - \dfrac{\sin^2\theta}{\cos^2\theta} \div \sec^2\theta$ $= \cos^2\theta - \dfrac{\sin^2\theta}{\cos^2\theta} \times \cos^2\theta$ $= \cos^2\theta - \sin^2\theta$ $=$ RHS. $\therefore$ LHS $=$ RHS. $\dfrac{1-\tan^2\theta}{1+\tan^2\theta} = \cos^2\theta - \sin^2\theta$	use LHS = RHS.