Full Name: SOLUTIONS

Ellenbrook
CHRISTIAN COLLEGE

MATHEMATICS METHODS

Test 2 – Equations, Polynomials, Functions and Graphs

Chapters 1 and 4

Semester 1 2015

Section One - Calculator Free

Time allowed for this section

Working time for this section: 25 minutes
Marks available: 24 marks

Material required/recommended for this section

To be provided by the supervisor

This Question/Answer booklet
Formula sheet

To be provided by the candidate

Standard items: pens, pencils, pencil sharpener, eraser, correction fluid, ruler, highlighters

Special items: drawing instruments, templates, notes and up to three calculators satisfying the conditions set by the Curriculum Council for this course.

Important note to candidates

No other items may be used in this section of the examination. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Multiple choice questions – select the best response

1. (1 mark)
Find the equation of the function that is 5 units to the left of $y = x^2$ and 1 unit down.

A $y = (x+5)^2 - 1$
B $y = (x+5)^2 + 1$
C $y = (x-5)^2 + 1$
D $y = 5x^2 - 1$
E $y = (x-5)^2 - 1$

2. (1 mark)
Find the gradient of the line that is perpendicular to the straight line with equation $2x + 6y - 1 = 0$

A -3
B $\frac{1}{3}$
C $-\frac{1}{2}$
D $-\frac{1}{3}$
E 3

3. (1 mark)
Make a the subject of the formula $v^2 = n^2(a^2 - x^2)$.

A $a = \pm\sqrt{\frac{v^2 + x^2}{n^2}}$
B $a = \pm\sqrt{\frac{v^2 - n^2x^2}{n^2}}$
C $a = \pm\sqrt{\frac{v^2 - x^2}{n^2}}$
D $a = \pm\sqrt{\frac{v^2 + n^2x^2}{n^2}}$
E $a = \pm\sqrt{\frac{v^2}{n^2} - x^2}$

4. (1 mark)
One or more errors have been made in the solution to this linear equation. State where the error(s) occurred.

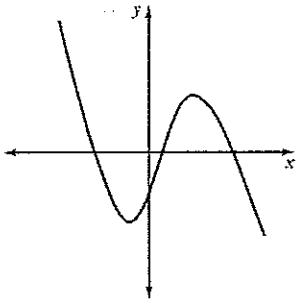
$$\frac{x-1}{3} - \frac{5x-7}{4} = 2 - x$$
$$4(x-1) - 3(5x-7) = 2 - x \quad \text{Line 1}$$
$$4x - 4 - 15x - 21 = 2 - x \quad \text{Line 2}$$
$$-11x - 25 = 2 - x \quad \text{Line 3}$$
$$-10x = 27$$
$$x = -2.7$$

A Line 1 only
B Line 2 only
C Line 3 only
D Line 1 and Line 2

E Line 1, Line 2 and Line 3

5. (2 marks)
Which graph is not a function? Indicate on your choice your reason.

A



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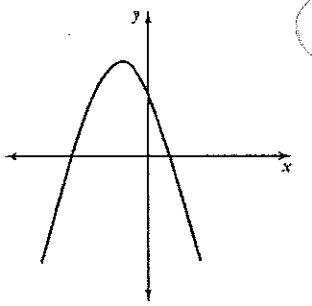

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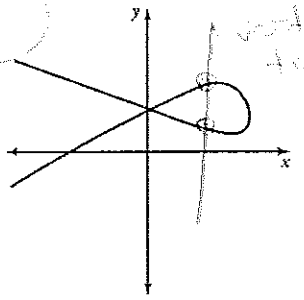
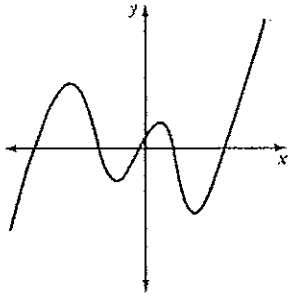
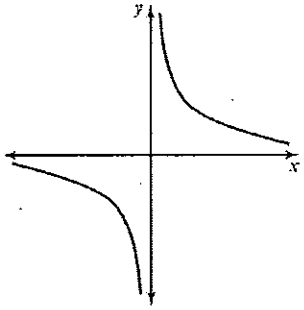


D



E



Short Answer Questions

6. (2 marks)
Solve $3 + 2(m - 4) = 4m - (3m - 2)$

$3+2m-8=4m-3m+2$

$2m-5=m+2$

$m=7$

7. (4 marks)
Solve the following equations:

a. $(3x - 2)(x + 9) = 0$

$3x-2=0$ $\quad$ $x+9=0$

$x=\frac{2}{3}$ $\quad$ $x=-9$

b. $x^2 - 7x + 4 = 0$ (using the quadratic formula)

$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

$x=\frac{7\pm\sqrt{(-7)^2-4(1)(4)}}{2}$

$=\frac{7\pm\sqrt{33}}{2}$

$=\frac{7+\sqrt{33}}{2}$ or $\frac{7-\sqrt{33}}{2}$

8. (4 marks)
Mike had a pen with chickens and rabbits in it. Between them, the animals had 42 heads and 142 feet. Write equations and solve them to find out how many chickens and how many rabbits there were in the pen.

$2c + 4r = 142$

$c + r = 42$ ... (1)

$2c + 2r = 84$

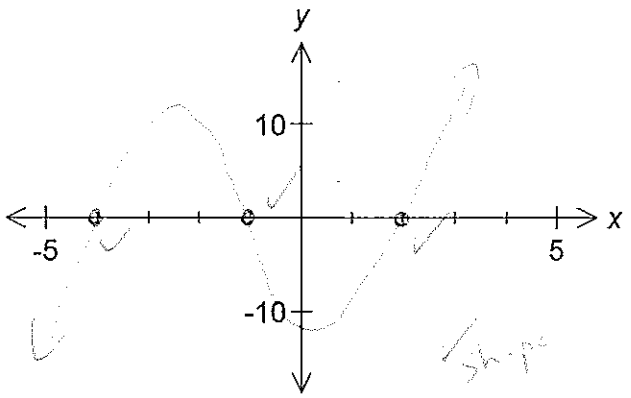
subtract $2r = 58$

$r = 29$

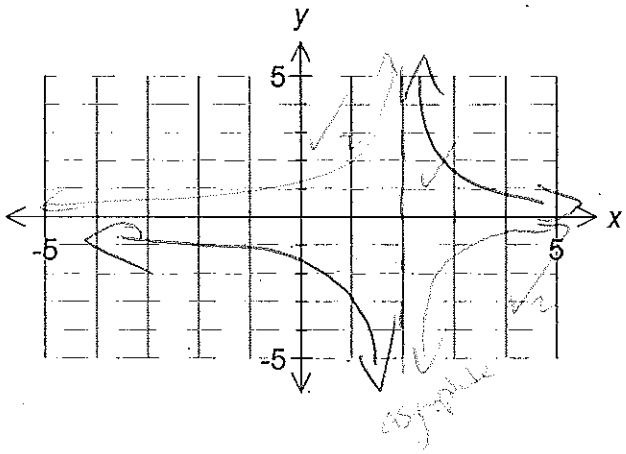
$c = 13$

9. (8 marks)
Sketch the following functions:

a. $y = (x-2)(x+1)(x+4)$



b. $y = \dfrac{1}{x-2}$



End of Section One

Full Name: SOLUTIONS

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MATHEMATICS METHODS

Test 2 – Equations, Polynomials, Functions and Graphs

Chapters 1 and 4

Semester 1 2015

Section Two - Calculator Assumed

Time allowed for this section

Working time for this section: 45 minutes
Marks available: 40 marks

Material required/recommended for this section

To be provided by the supervisor

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Multiple choice questions – select the best response

1. Find the domain and range of $y=\sqrt{2-x}$.

   A Domain {x: all real x}, range {y: all real y}

   B Domain {x: all real $x \geq 2$}, range {y: all real $y \geq 0$}

   C Domain {x: all real $x \neq 2$}, range {y: all real $y \geq 0$}

   D Domain {x: all real $x \leq 2$}, range {y: all real $y \geq 0$}

   E Domain {x: all real $x \geq 2$}, range {y: all real $y \leq 0$}

2. Determine the *solutions* of $p(x)=2x^3+9x^2-5x$

   A $-5, 0, \frac{1}{2}$

   B $-\frac{1}{2}, 0, 5$

   C $0, 1, 5$

   D $0, 2, 5$

   E $-5, 0, 2$

3. Factorise $x^3+6x^2+5x-12$.

   A $(x-1)(x-3)(x+4)$

   B $(x-1)(x+3)(x+4)$

   C $(x-1)(x-3)(x-4)$

   D $(x+1)(x-3)(x+4)$

   E $(x+1)(x+3)(x-4)$

4. Solve the equation $2x^2+7x-3=0$, for x correct to 2 decimal places.

   A $x=-3.89$ and 0.39

   B $x=-0.5$ and -3

   C $x=-0.77$ and -7.72

   D $x=0.39$ and 3.89

   E $x=0.77$ and 7.72

5. Solve the equations $8a+b=-12$ and $4a-3b=-20$ simultaneously.

   A $a=2, b=-28$

   B $a=-3.5, b=16$

   C $a=-2.\overline{6}, b=-3.\overline{1}$

   D $a=2, b=-28$

   E $a=-2, b=4$

Short Answer Questions

6. (2 marks)
Solve $3x^2 - 5x - 12 = 0$

$x = 3, \quad x = -1.3$ ✓ ✓

7. (2 marks)
For the function $P(x) = 2x^3 + 4x^2 - x + 1$, find the remainder when $P(x) \div (x - 4)$

$$
\begin{array}{r|l}
x-4 & 2x^3+12x+47 \\
\hline
 & 2x^3+4x^2-x-1 \\
 & -(2x^3-8x^2) \\
 & \quad 12x^2-x \\
 & \quad -(12x^2-48x) \\
 & \quad\quad 47x-1 \\
 & \quad\quad -(47x-188) \\
 & \quad\quad\quad 187
\end{array}
$$

remainder 187 ✓

8. (3 marks)
The amount of fuel used by a car is directly proportional to the distance travelled. On a trip of 810 km, a family car used 60 litres of fuel. How far could the car travel on 76 litres of fuel?

$\frac{810}{60} = \frac{x}{76}$ ✓

$x = 1026$ km ✓

9. (6 marks)
For the given points $A(-2, 3)$ and $B(-1, -4)$:

a. find the midpoint M of A and B

$M = \left(\frac{-2+-1}{2}, \frac{3+-4}{2}\right)$

$= \left(-\frac{3}{2}, -\frac{1}{2}\right)$ or $(-1.5, 0.5)$

b. find the distance between A and B

$d = \sqrt{(-2--1)^2+(3--4)^2}$

$= \sqrt{1+49}$

$= \sqrt{50}$

$= 7.07$

c. find the gradient of line AB

$m = \frac{-4-3}{-1--2}$

$= \frac{-7}{1}$

$= -7$

10. (4 marks)
State domain and range of the following functions:

a. $y = x^4 - 3x^3 + 5x^2 - 8x + 14$

D is real. Polynomial degree 4

R is $y \geq 8.18$

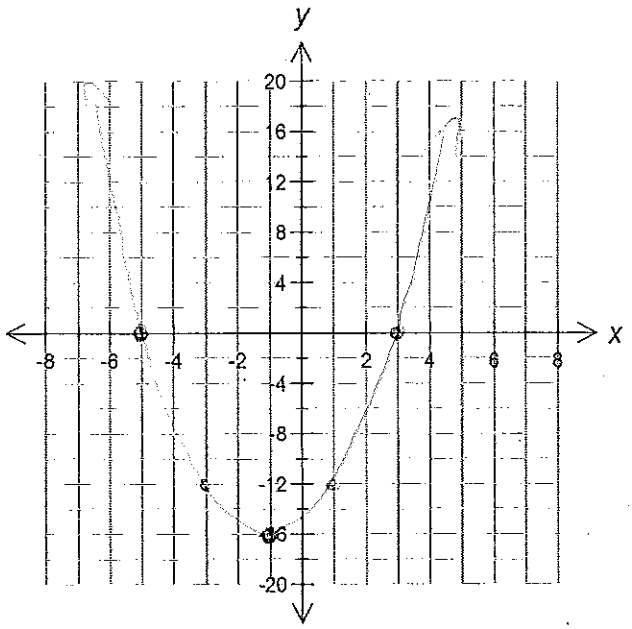
b. $y = -\frac{2}{3-x}$

D: $x \neq 3$

R: $y \neq 0$

11. (4 marks)

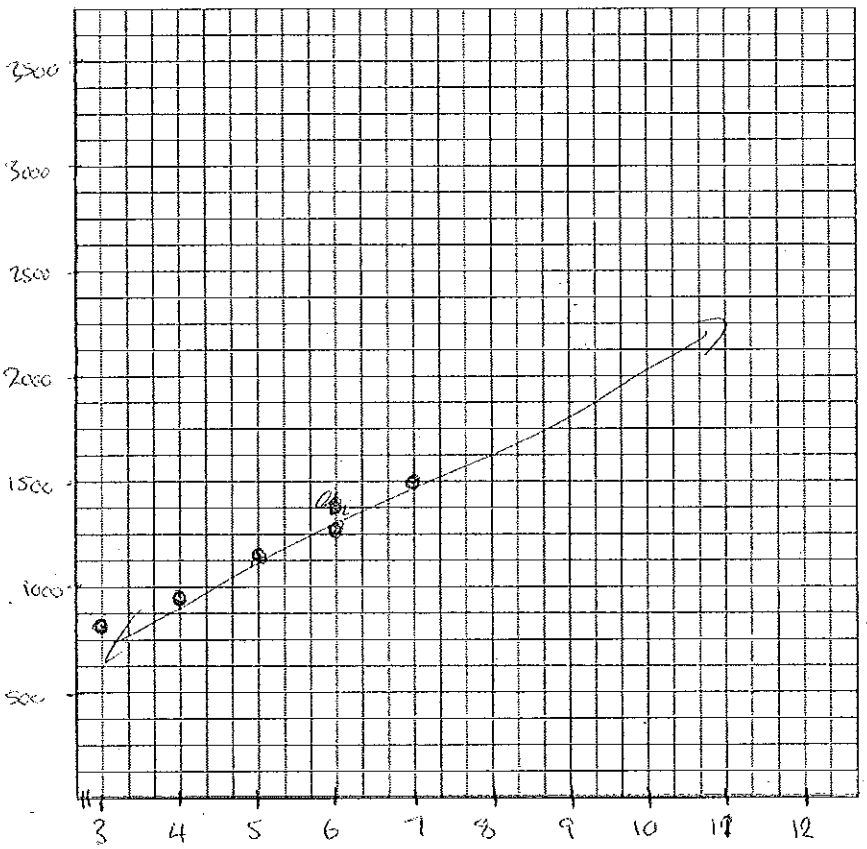
Graph $y = x^2 + 2x - 15$



12. (14 marks)

A Wilderness Trekking tour operator offers complete packages to the Tasmanian World Heritage areas from Launceston. The cycling tours may be from 3 to 12 days in length. They cost $780 for the 3-day tour and $180 for each additional day.

a. Draw a graph showing the cost of the cycling tours. [4]

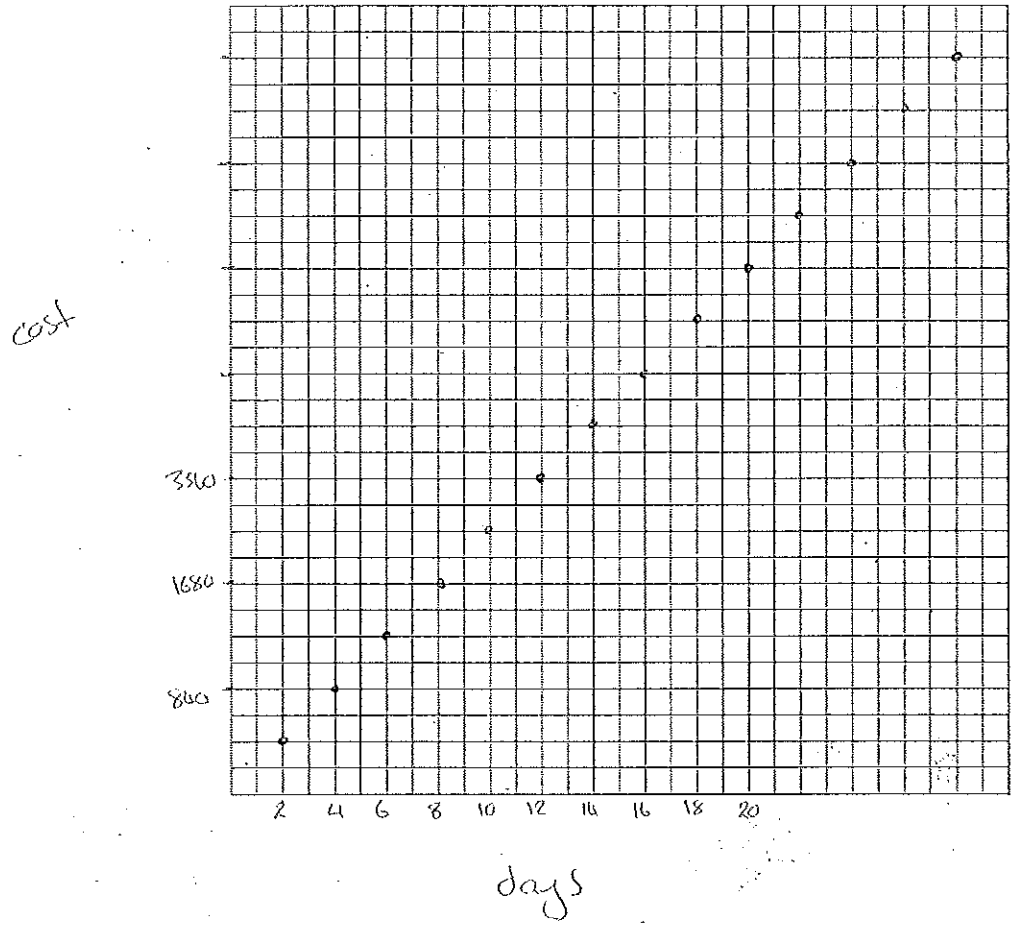


b. Find a relationship between the number of days and the cost of the tours. [2]

$C = 780 + 180(d - 3)$

The operator also offers walking treks of any duration from 1 to 20 days with a flat rate of $210 per day.

c. Draw a graph of the cost of the walking treks. [4]



d. Find a relationship between the number of days and the cost of the treks. [2]

$C = 210d$

e. State the circumstances under which each of the walking or cycling options would be cheaper. [2]

Tour cheaper upto 8 days.

Trek cheaper after 8 days

End of Test