Student Name……..

Teacher (circle one) JOR CWE

Homegroup ……

MATHEMATICAL METHODS (CAS) UNIT 1

EXAMINATION 2

Wednesday, 3th June, 2015

Reading Time: 9.00 – 9.15 (15 minutes)
Writing time: 9.15 – 10.45 (90 minutes)

Instructions to students

This exam consists of Section 1 and Section 2.

Section 1 consists of **12** multiple-choice questions, to be answered on the separate answer sheet. It is worth **12** marks.

Section 2 consists of **12** extended-answer questions that should be answered in the spaces provided. It is worth **77** marks

There is a total of **89** marks available.

All questions in Section 1 and Section 2 should be answered.

Unless otherwise stated, diagrams in this exam are not drawn to scale.
Where more than one mark is allocated to a question, appropriate working must be shown.
Where an exact answer is required to a question, a decimal approximation will not be accepted.
Students may bring one bound reference into the exam.
Students may bring an approved CAS calculator.

SECTION 1: MULTIPLE-CHOICE QUESTIONS

1 Which of the following relations are functions?

I $(x-2)^2+(y+1)^2=16$

II $y^2=\frac{2}{3}x-1$

III $y=-2x+4$

IV $y=4x^2$

A I and III
B III and IV
C I and II
D II and III
E I and IV

2 If $f(x)=2+\frac{3}{x}$ then the value of $f(3)-f(6)$ is

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

3 The expansion of $(x-3)^3(x+2)$ is given by

A x^2+x-12
B $x^3-2x^2-15x+36$
C $x^4+4x^3-27x-54$
D $x^4-7x^3+9x^2+27x-54$
E $x^4-5x^3-9x^2+81x-108$

4 The graph of the parabola with equation $y = -(x + 3)^2 - 2$ has a turning point with coordinates

A (– 3, –2)
B (– 3, 2)
C (3, –2)
D (9, –2)
E (3, 2)

5 The equation $3x + 2y - 2 = 0$ has gradient and y-intercept respectively equal to:

A 3, –2
B –2, 4
C $\frac{2}{3}, \frac{4}{3}$
D $-\frac{3}{2}$, 1
E $-\frac{2}{3}$, 4

6 The variables a and b are related by the formula $a=\frac{4b}{b-1}$.
Rearrangement of the formula shows that b is equal to:

A $\frac{4a}{a+4}$
B $\frac{a}{a+4}$
C $\frac{a+4}{a}$
D $\frac{4a}{4+a}$
E $\frac{a}{a-4}$

7 A function has rule $f(x) = \sqrt{x+3}-5$.
The (implied) domain and range are:

A domain: [3, ∞); range: [– 5, ∞)
B domain: [– 3, ∞); range: [– 5, ∞)
C domain: (3, ∞); range: (– 5, ∞)
D domain: (– 3, ∞); range: (– 5, ∞)
E domain: [– 3, ∞); range: R

8 The maximal domain and range for $g(x)=\dfrac{2}{1+3x}$ are respectively:

A $R\setminus\left\{-\dfrac{3}{2}\right\}$ and $R\setminus\{0\}$

B $R\setminus\left\{-\dfrac{2}{3}\right\}$ and $R\setminus\{4\}$

C $R\setminus\left\{-\dfrac{1}{3}\right\}$ and $R\setminus\{0\}$

D $R\setminus\left\{-\dfrac{2}{3}\right\}$ and $R\setminus\{0\}$

E $R\setminus\left\{\dfrac{2}{3}\right\}$ and $R\setminus\{4\}$

9 The points (1, 4), (2, 0) and (4, *p*) lie on a straight line. The value of *p* is:

A +2

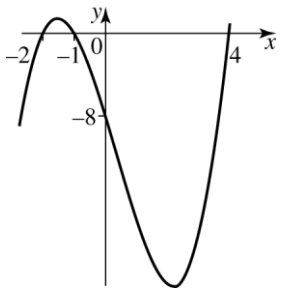
B – 2

C – 4

D – 6

E – 8

10



The graph above represents the equation:

A $f(x)=(x-2)(x-1)(x+4)$

B $f(x)=-8(x+2)(x+1)(x-4)$

C $f(x)=(x+2)(x+1)(x-4)$

D $f(x)=(x-2)(x-1)(x+4)(x-8)$

E $f(x)=(x+2)(x+1)(x-4)(x+8)$

11 The expression $\dfrac{(m^2n)^4}{(2m^5n^2)^3}\div\dfrac{(m^5n^2)^2}{2mn^5}$ can be simplified to:

A $\dfrac{1}{4m^{16}n}$

B $\dfrac{2^2}{m^{16}n}$

C $\dfrac{1}{4m^8}$

D $\dfrac{1}{4m^{16}n}$

E $2^2m^{16}n$

12 The expression $\log_n\left(\dfrac{1}{n^4}\right)$ equals:

A $\dfrac{n}{4}$

B $4n$

C 4

D n^{-4}

E -4

SECTION 2 EXTENDED-ANSWER QUESTIONS

13. A line joins the points with coordinates (–2, 5) and (6, 9).
Find:

a) The equation of the line that joins the 2 points.

b) The exact value (in simplest form) of the direct distance between the 2 points.

c) The midpoint of the line.

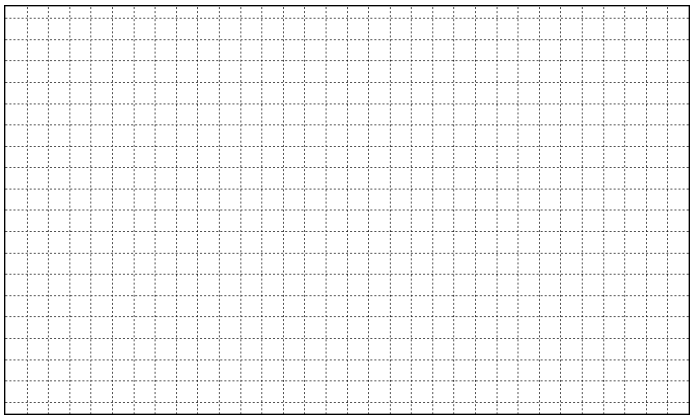
d) The equation of the perpendicular bisector of the line.

e) State the domain and range of the line segment joining the points (-2, 5) and (6,9)

2 + 2 + 2 + 3 + 2 =11 marks

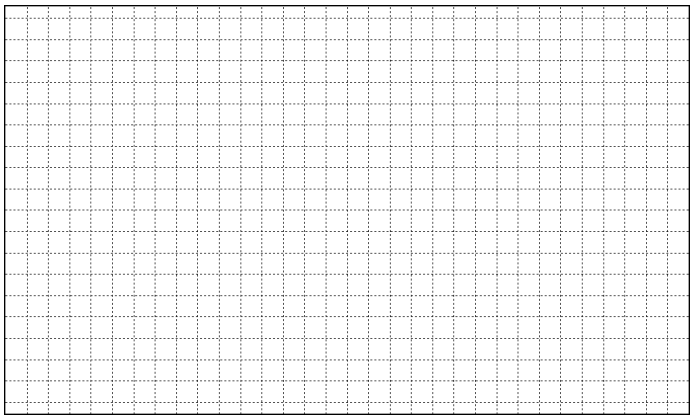
14. Sketch the graphs of each of the following equations. State the domain and range of each.

a) $y = \sqrt{x} + 1$, where $x \in R$



Domain:
Range:

b) $y = 2x + 1$, where $x \in \{0,1, 2, 3, 4\}$



Domain:
Range:

3 + 3 = 6 marks

15. . (i) Sketch each of the following graphs, labelling the point of inflection or equation of any asymptotes where appropriate.

NOTE: You do **not** need to calculate any *x* or *y* intercept.

(ii) State the equation of the relevant basic shape graph.

(iii) State all dilations and translations required to draw them from the basic shape.

$y = 3(x-1)^3 + 4$ (ii) _____ (iii)	$y = 3 \times 2^{x+1} - 2$ (ii) _____ (iii)

3+ 3 = 6 marks

16. a) Convert the following quadratic into turning point form: $y = x^2 + 4x - 7$

a) Hence, state the co-ordinates of the turning point.

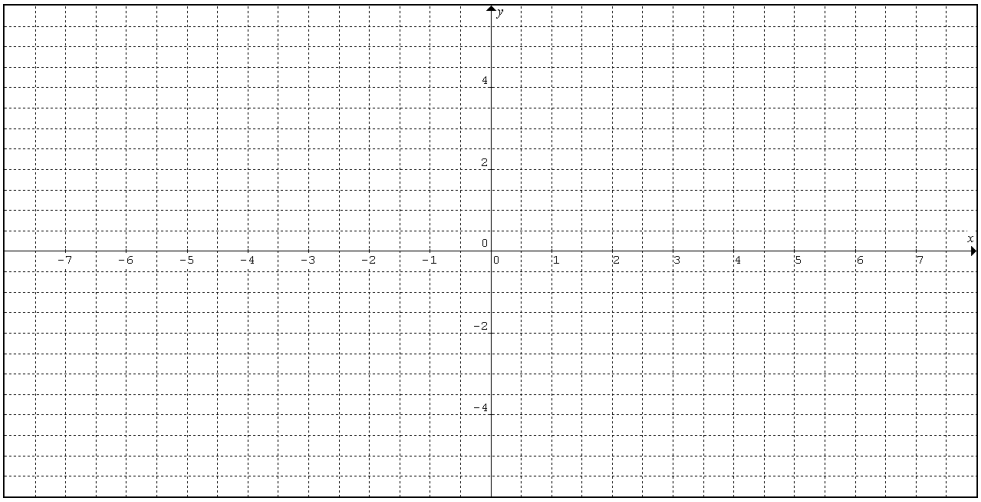
b) State the domain and range

c) What translation would map the parabola $y = x^2$ onto $y = x^2 + 4x - 7$?

2 + 1 + 2 + 2 = 7 marks

17. If $f(x) = \begin{cases} 3 - x^2 & , \quad x \geq 0 \\ x + 4 & , \quad x < 0 \end{cases}$

Sketch this graph.



Find:

a) the range of *f*(*x*) and

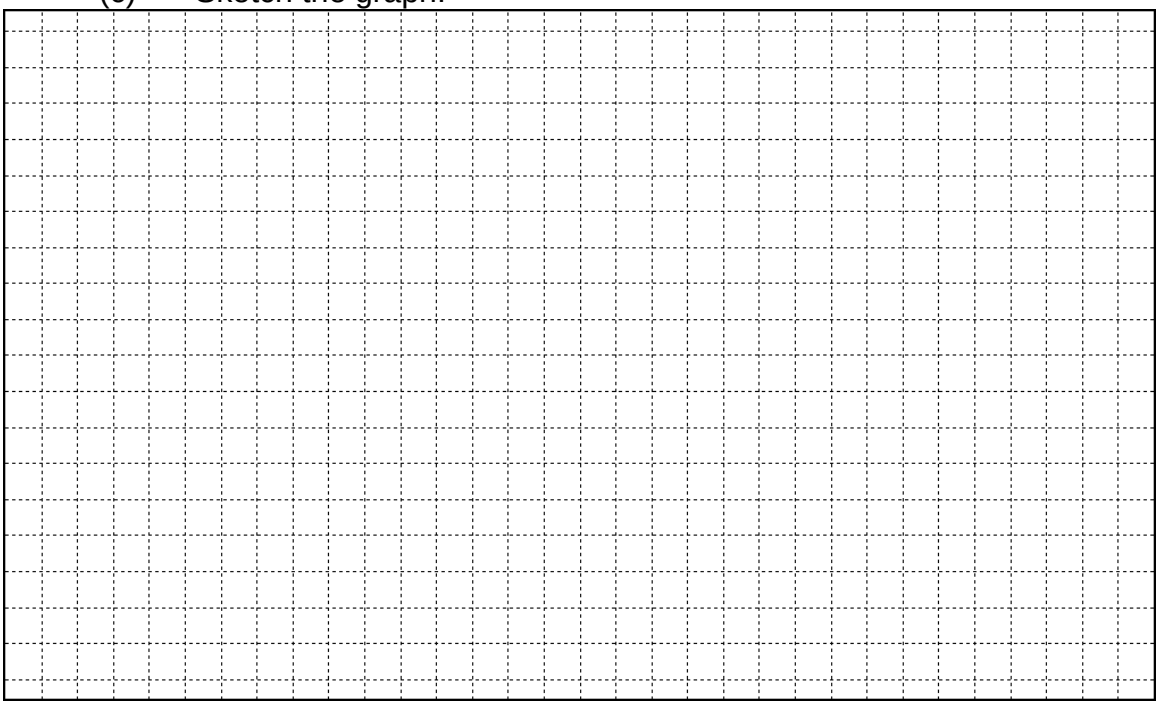
b) the value for *f*(–2).

3+2 = 5 marks

18. (a) Factorise $x^3 - 5x^2 - 4x + 20$

(b) What are the co-ordinates of the axes intercepts for the graph of $= x^3 - 5x^2 - 4x + 20$?

(c) Sketch the graph.



(d) What are the co-ordinates of the turning points, correct to correct to 2 decimal places.

1 + 2 +2 + 2 = 7 marks

19. Rewrite these in interval notation:

(a) $R^+ \backslash \{5\}$ _____

(b) $R^+ \backslash \{1 \leq x < 4\}$ _____

(c) $R^+ \cup \{-5 < x < -3\}$ _____

3 marks

20. If $f(x) = 3 - x^2$, find:

a) f(-2)

b) $f(m-3)$

1 + 2 = 3 marks

21. Write in simplest index notation:

a) $3^{n+1} \times 9^{2n+3} \div 27^{1-3n}$

b) $\dfrac{(a^{-3}\sqrt{b^3})^4 \times (\sqrt{2}a^4b^{-3})^3}{\sqrt{2}\left(ab^{-2}\right)^{-2}}$

2 + 3 = 5 marks

22. Solve for x in the following equations:

a) $3^{4x+1} = 243$

b) $5^{2x} - 6(5^x) + 5 = 0.$

2 + 3 = 5 marks

23.

a) Evaluate $\log_2(256)$, showing all working

b) Simplify $4\log_{10} 2 - 2\log_{10} 8$

c) Solve for *x* where $\log_5(2x - 3) = 2$

2 + 2 + 2 = 6 marks

24. The number of rabbits that are left on a farm *t* weeks after a virus is released is given by the function

$$N(t) = 15 + \frac{96}{t+3}$$ rabbits per hectare.

(a) How many rabbits per hectare were on the farm when the virus was released?

(b) How many rabbits per hectare are there 13 weeks after the virus was released?

(c) How long after the virus is released are there 23 rabbits per hectare?

(d) Will the virus kill all the rabbits? Explain your answer.

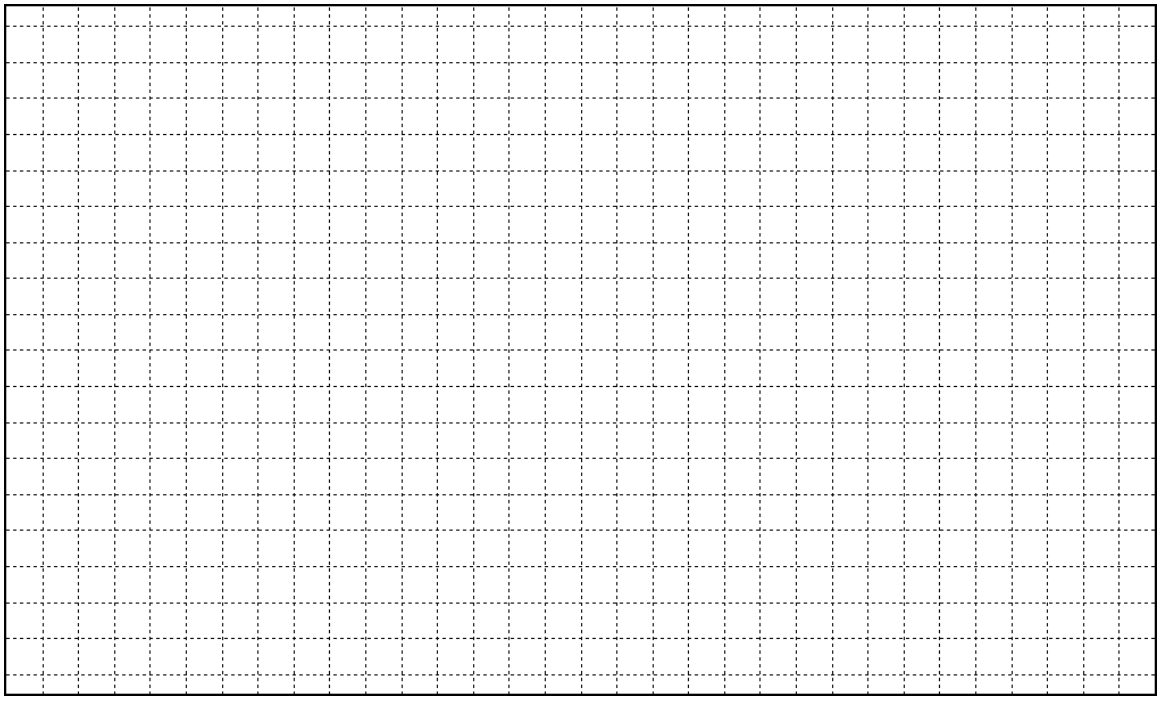
1 + 1 + 2 + 2 = 6 marks

25. The cost of hiring a moving van is described in the table below:

Hours of Hire	Cost
Up to 1	$40
Over 1 up to 2	$70
Over 2 up to 4	$110
Over 4 up to 8	$160

a) State the cost function, C(t), for hiring up to 8 hours

b) Sketch the graph of the function



c) State the domain and range of the function.

2 + 3 + 2 = 7 marks

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