Student Name……..

Teacher (circle one) AMA VNA

Homegroup ……

MATHEMATICAL METHODS (CAS) UNIT 1

EXAMINATION 1

Thursday June 8th 2017

Reading Time: 11.30 – 11:45pm (15 minutes)
Writing time: 11:45 – 12:45pm (1 hour)

Instructions to students

This exam consists of **11** questions.
All questions should be answered in the spaces provided.
There is a total of 52 marks available.
A decimal approximation will not be accepted if an exact answer is required.
Where more than one mark is allocated to a question working must be shown.
Students **may not** bring any notes or any calculators into this exam.
Diagrams in this exam are not to scale except where otherwise stated.

FORMULAS

Function and Graphs

Distance formula $d_{AB} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ Midpoint formula $x_M, y_M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

Straight line graphs

General equation $y = mx + c$ Gradient $m = \frac{y_2 - y_1}{x_2 - x_1}$

Equation through point (x_1, y_1) given by $y - y_1 = m(x - x_1)$

Difference/sum of squares and cubes

$a^2 - b^2 = (a + b)(a - b)$

$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Expansions

$(a + b)^2 = a^2 + 2ab + b^2$

$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$

1. Solve each of the following

(a) $5 - 2x > 7$	(b) $x^2 + 3x - 4=0$

1 + 2 = 3 marks

2. (a) Solve the pair of simultaneous equations:

$15x - 3y = -21$

$4x + 7y = 10$

(b) Tickets to a Billanook Performance cost $30 for adults and $10 for children. It is very popular and the takings for the performances were $11,000 from the 700 people that attended them. Find the number of children and the number of adults that attended.

2 + 3 = 5 marks

3. Expand and simplify where appropriate

(a) $(x + 3)(x^2 – 3x + 7)$

(b) $2x\,(x^4 – 3x^2 + 3) – 4x^2(x + 3)$

1 + 1 = 2 marks

4. For each of the following find the equation (or an equation) that fits the information:

(a) a straight line passing through (-1, 3) that is perpendicular to the line $y = 3x + 4$

(b) a parabola with a turning point at (-3, 7)

(c) a cubic function with a turning point at (-3, 0) and x-intercept at (2, 0)

.

(d) The line passing through the midpoint of (-3, 4) and (5, -2) with gradient 2.

2 + 1 + 1 + 2 = 6 marks

5. For A = $\begin{bmatrix} 1 & -3 \\ 2 & 1 \end{bmatrix}$ B = $\begin{bmatrix} 0 & 3 \\ -2 & 1 \end{bmatrix}$ find

a) AB	b) A^{-1}

2 x 2 = 4 marks

6. A die is rolled and a coin is tossed:

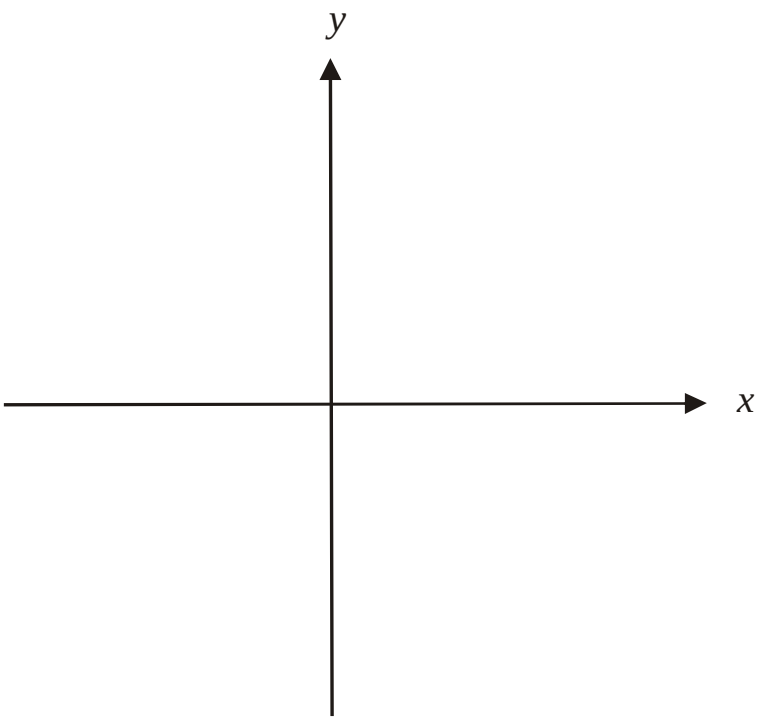
(a) Draw a tree diagram to show the situation including probabilities.

(b) Find the probability of an even number being rolled and then a head being tossed.

(c) Given that an odd number has been rolled, what is the probability of a head?

2 + 1 + 1 = 4 marks

7. **(a)** Sketch the function $y = \frac{9}{(x+1)^2} - 4$. Include any intercepts, asymptotes and any other main feature(s)



b) What is the domain and range of this relation?

c) The domain is restricted so that it is a one-to-one function. The restricted domain is (a, ∞). What is the smallest possible value of a?

d) Find the inverse of the function with this restricted domain in the form of $f^{-1}(x) =$

4 + 2 + 1 + 2 = 9 marks

8.(a) Show that $3x^2 - 6x + 7$ is the same as $3(x - 1)^2 + 4$

(b) Hence state the transformations that $y = x^2$ must undergo to become $y = 3x^2 - 6x + 7$ by filling in the gaps:

_____ by _____from ____ axis

Translated by _____along_____axis

Translated by _____along_____axis.

(c) Find the matrices *T and A* that complete the transformations for (b) such that $TX + A = X'$ where X = $\begin{bmatrix} x \\ y \end{bmatrix}$ and X' = $\begin{bmatrix} x' \\ y' \end{bmatrix}$

(d) Using the results from **(c)** (or otherwise) find the equation of $y = \frac{1}{x}$ when it has undergone the same transformations.

2 + 2 + 2 + 2 = 8 marks

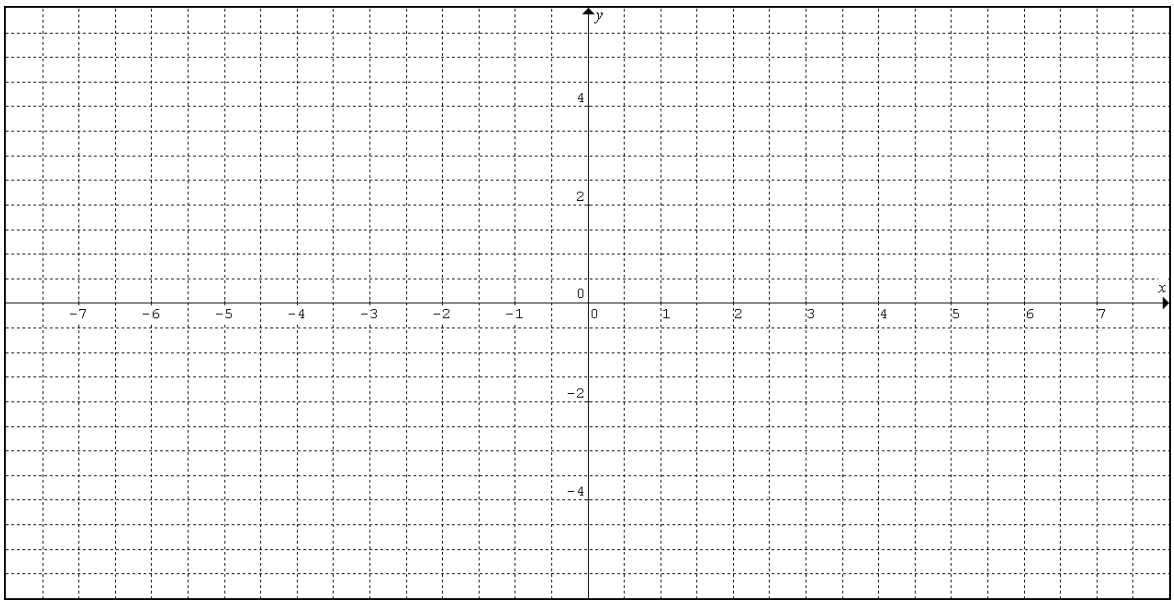
9. (a) By suitable substitution show that $(x - 1)$ is a factor of $f(x) = x^3 + 3x^2 - x - 3$

(b) Divide $f(x)$ by $(x - 1)$

(c) By finding the other factors of $f(x)$ solve $f(x) = 0$

1 + 2 + 2 = 5 marks

10. a) Sketch the graph of $h(x) = \begin{cases} \sqrt{x} & , \quad x \geq 1 \\ -2x & , \quad x < 1 \end{cases}$



b) Change one of the equations so that $h(x)$ is continuous

2 + 1 = 3 marks

11. A group of 50 students are surveyed. There are 12 who did an amazing job in house music as well as being school volleyball players. A total of 37 students play school volleyball. In the group of 50 there were 30 who didn't do house music.

(a) Put this information into a probability table

(b) Show whether playing school volleyball and being amazing in house music are independent.

2 + 1 = 3 marks

END OF EXAMINATION 1