Revision Examination Assessment Papers (REAP)
Semester 1 Examination 2012

Question/Answer Booklet
(This paper is not to be released to take home before 25/6/2012)

MATHEMATICS:
SPECIALIST   3A

Section Two:
Calculator-assumed

Name of Student: _____

Time allowed for this section
Reading time before commencing work: 10 minutes
Working time for this section: 100 minutes

Materials required/recommended for this section
To be provided by the supervisor
This Question/Answer Booklet
Formula Sheet (retained from Section One)

To be provided by the student
Standard items: pens, pencils, pencil sharpener, eraser, correction fluid/tape, ruler,
                      highlighters

Special items: drawing instruments, templates, notes on two unfolded sheets of A4 paper,
                      and up to three calculators satisfying the conditions set by the Curriculum
                      Council for this examination

Important note to students
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 in the examination room. If you have
any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
Section One Calculator-free	6	6	50	50	
Section Two Calculator-assumed	12	12	100	100	
			Total	150	100

Instructions to students

1   Write your answers in the spaces provided in this Question/Answer Booklet. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer. If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued. i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

2   **Show all your working clearly**. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat an answer to any question, ensure that you cancel the answer you do not wish to have marked.

3   It is recommended that you **do not use pencil**, except in diagrams.

4   You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.

Section Two: Calculator-assumed **(100 marks)**

This section has **twelve (12)** questions. Answer all questions. Write your answers in the spaces provided.

Working time: 100 minutes

_____

Question 7 **(10 marks)**

(a)   If $a = 6i - 4j, \ b = 3i + 4j, \ c = 2i + 5j$

   (i)   Determine $|c - b|$ Leave your answer as a surd   (2)

   (ii)   Determine $2b - 3a + c$ (2)

   (iii)   Determine a vector, v (in **exact** simplest form) in the direction of a
           such that $|v| = 5$.   (3)

(b)   Find the value of k if p and q are parallel vectors.

$$p = \sqrt{2} \begin{pmatrix} k \\ -3 \end{pmatrix}, \qquad q = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$$

(3)

Question 8   **(8 marks)**

(a)   Beijing in China is located at 40°N, 116°E. Perth in Western Australia is located at

32°S, 116°E. Karen's direct flight from Beijing to Perth departed at 11.00pm on Sunday. If
the plane had an average flying speed of 900km/h, how long does the flight take?
Express your answer in hours and minutes.
Take the radius of the earth to be 6360km.   (4)

(b)   Determine the equation for each of the following graphs by selecting from the list below.

$$y = \sqrt{x-2} + 1$$
$$y = 1 + \sqrt{x+2}$$
$$y = 2e^{-x}$$
$$y = e^{-x} + 2$$
$$y = -\ln 2x$$
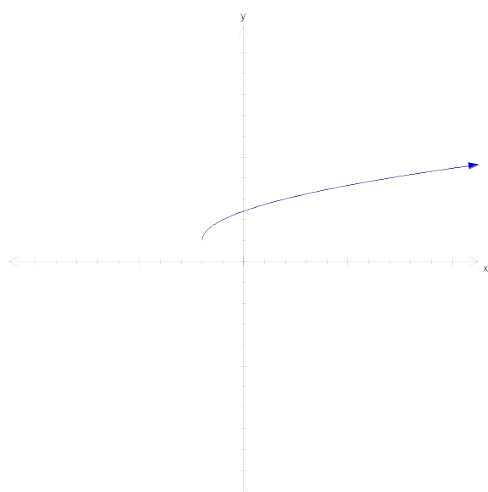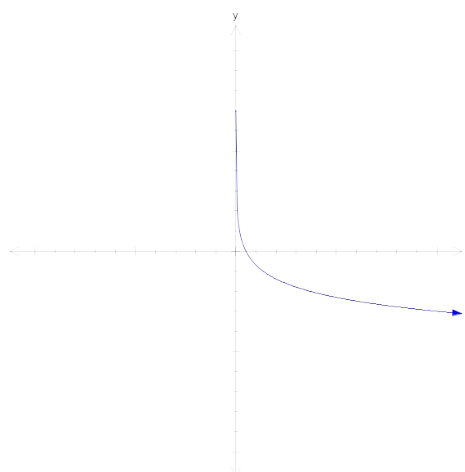$$y = -\ln \frac{1}{2}x$$
$$y = \frac{1}{x-1} - 2$$
$$y = \frac{1}{x+1} - 2$$

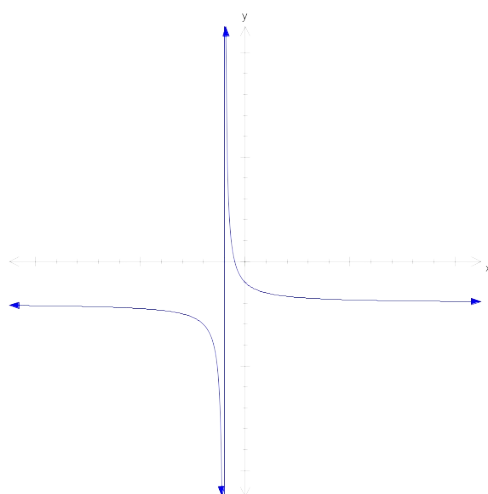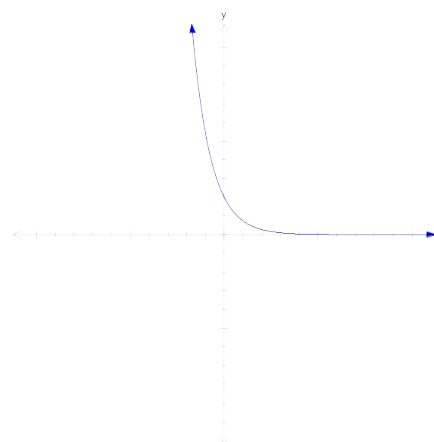   (4)
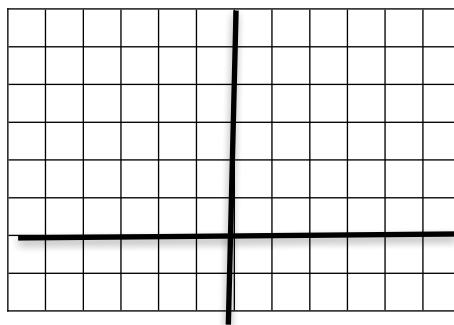
(i)

(ii)

(iii)

(iv)

Question 9   **(10 marks)**

(a)   Point A has position vector $k\underline{i} - \underline{j}$. Point B has position vector $6\underline{i} - k\underline{j}$.

If $\left|AB\right| = 5$, find the value(s) of k.   (4)

(b)   Let A= (5,1), B=(0,4), C=(-1,0)

   Find

   (Hint: Use the grid below to help you find the points)

   (i)   D such that $AB = CD$ (2)

   (ii)   F such that $AF = -BC$ (2)

   (iii)   G such that $AB = 2GC$ (2)

Question 10   **(10 marks)**

The area of $\triangle$ PQR is 16cm². PQ=8cm, $\angle$ RPQ=30°.

    (i)   Find the length of PR.   (2)

    (ii)   Hence, find the size of $\angle$ PQR.   (2)

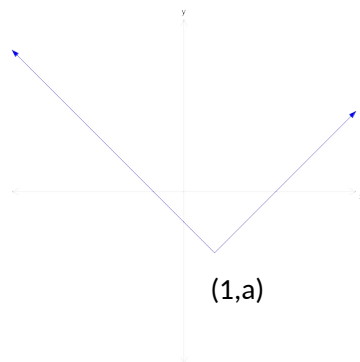   (iii)   Using the SINE rule and $\sin 75° = \dfrac{1+\sqrt{3}}{2\sqrt{2}}$, show that $QR = 4\sqrt{2}\left(\sqrt{3}-1\right)$
             Show all working steps.   (6)

Question 11   **(9 marks)**

The diagram shows the graph of $y=f(x)$, $x \in R$.

(1,a)

If $f(x) = |x - 1| - 2$,

(i)   Find the value of a and the value of b.   (2)

(ii)   Solve **algebraically** the value of x for which $f(x) = 5x$ (3)

(iii)   Determine the solution set for $|x - 1| - 2 = x - 3$ (2)

(iv)   Find the value of k for which $|x - 1| - 2 = x + k$ has no solution.   (2)

Question 12   **(8 marks)**

(a)   The population, P, of cane toads in Australia has been growing at a rate proportional to P,

$$\frac{dP}{dt} = kP$$

such that   where k is a positive constant. There were 102 cane toads brought to
Australia in 1935. Seventy six years later, in 2011, it is estimated that there are 243 million
cane toads in Australia.

(i)   Find the value of 'k' to 4 decimal places.   (2)

(ii)   If the population continues to grow at this rate, how many cane toads will there be
in Australia in 2035?   (2)

(b)   In 2005 there were 13.8million registered motor vehicles in Australia. The number of
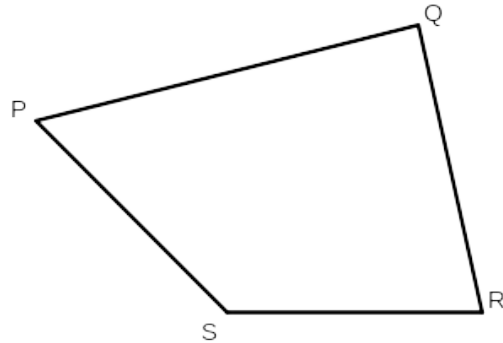registered motor vehicles is increasing at a rate of 2.3°/ₒ per year.

(i)   Write an expression to represent the number (in millions) of registered motor
vehicles, N, if t represents the number of years after 2005.   (2)

(ii)   Hence determine the number of registered vehicles in Australia in 2011.
(2)

Question 13   **(6 marks)**

In the diagram $PQ = 2\underline{b}$, $PS = 4\underline{a}$ and $SR = 2\underline{a} + \underline{b}$

(a)   Express as simply as possible, in terms of $\underline{a}$ and/or $\underline{b}$ (2)
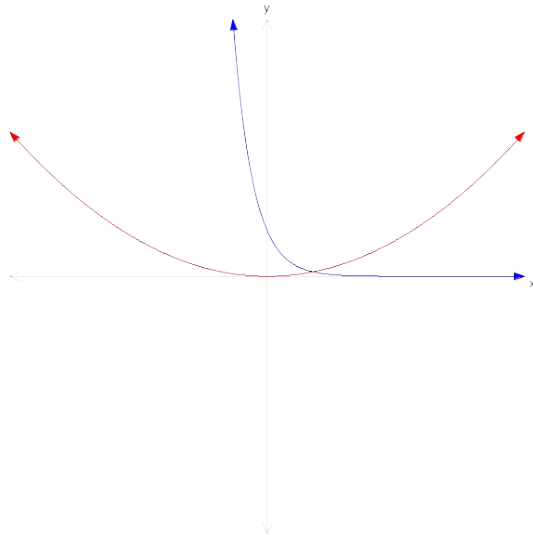
    (i) SQ

    (ii) QR

(b)   If $PT = hPR$, express PT in terms of $h, \underline{a}$ and $\underline{b}$ (1)

(c)   Given that $4ST = SQ$, calculate the value of h.   (3)

Question 14   **(11 marks)**

The diagram shows the graph of $f(x) = a^x$ and $g(x) = bx^2$. The graph $f(x)$, intersects $g(x)$ at $\left(1, \dfrac{1}{10}\right)$

(a)   Calculate the value of a and b.   (2)

(b)   Write down the equation of the inverse function, $f^{-1}(x)$.   (3)

(c)   Why does the function $g(x)$ not have an inverse function?   (1)

(d) Write down two ways in which the domain of $g(x)$ could be restricted in order that $g(x)$ can have
     an inverse function.   (2)
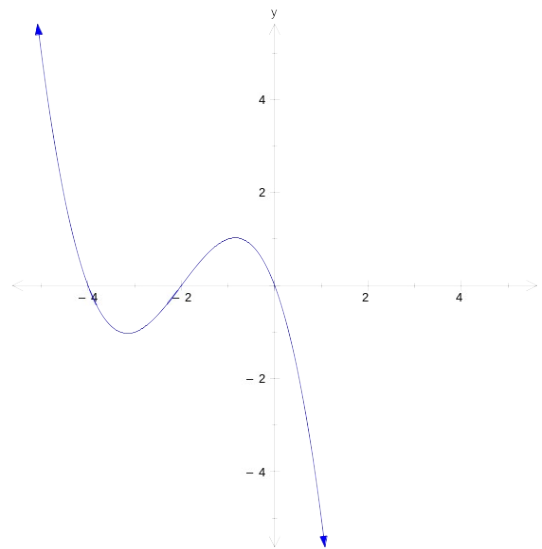
(e)   Determine the x-values for which

         (i) $f^{-1}(x) > 0$ (2)

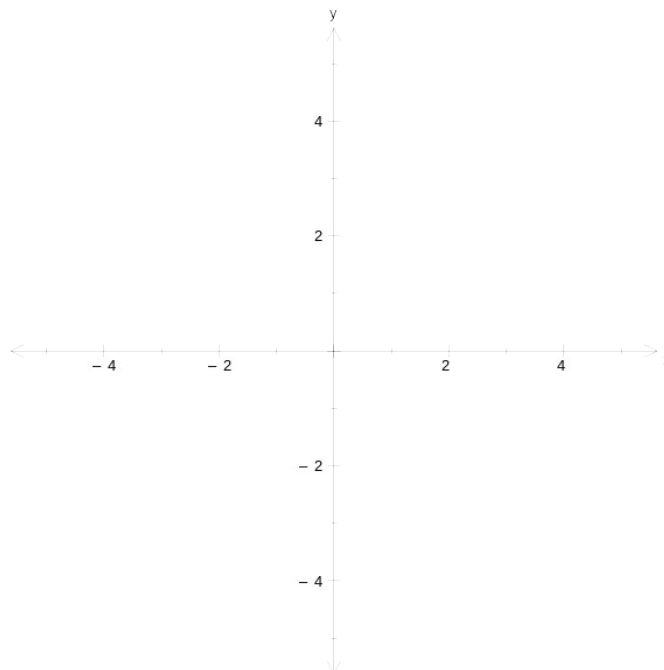   (ii) $f(x) - 1 = g(x)$ (1)

Question 15   **(6 marks)**

The diagram shows the graph of *y=f(x)*
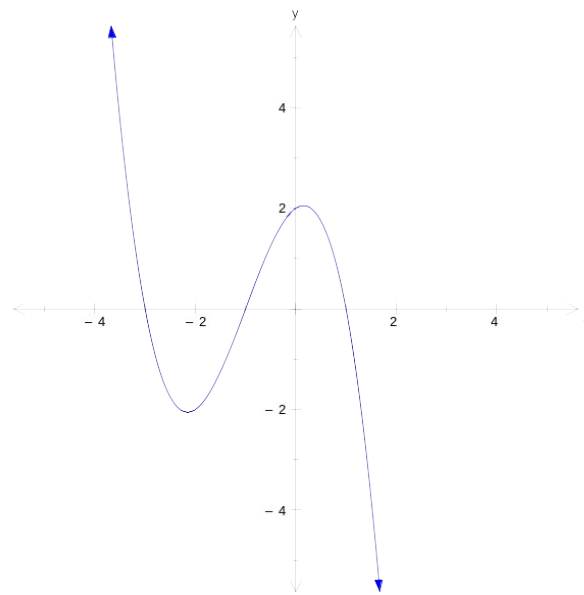

(i)   Sketch the graph of

$$y = |f(x-1)|$$ showing clearly the coordinates of the turning points and the intersections
with the axes.   (3)

(ii)   *f(x)* has been transformed and the transformed graph is shown below.

State the equation of the transformed graph in terms of *f(x)*.   (3)
Show how the point (-3,-1) is transformed to (-2,-2).

Question 16   **(6 marks)**

(a)   Find a simple expression for $e^{2\ln x}$ (1)

(b)   Solve the equation graphically $2e^x=4x+3$.

         Express your answers to 2 decimal places.   (2)

(c)   Solve $3 \times 9^{x+1} = 81^{2x}$ (3)
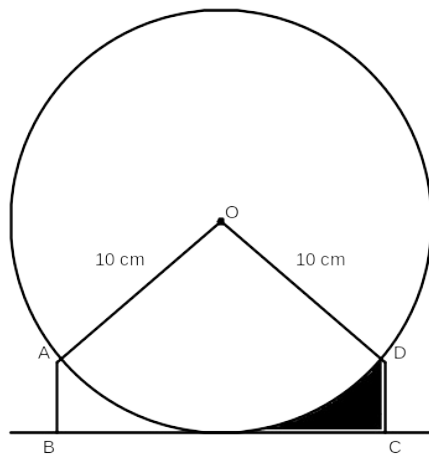
Question 17   **(7 marks)**

M is the mid-point of line segment AB.

If OA, OB and OM are $\underline{a}$, $\underline{b}$, $\underline{m}$ respectively

(a)   Show that $\underline{m} = \dfrac{1}{2}(\underline{a} + \underline{b})$ (4)

(b)   Hence, or otherwise state the coordinates of *S* if *S* divides the line segment joining F(1,4) to G(6,9) in the ratio 1:1.   (3)

Question 18   **(9 marks)**

The diagram shows a circle of radius 10cm, centre O and a tangent BC of length 16cm, AB=DC, calculate

(i) $\angle$ AOD in radians, to 2 decimal places.   (4)

(ii)   the area of the shaded region.   (5)