ST MARY'S DSG, KLOOF

GRADE: 12   1 SEPTEMBER 2011

MATHEMATICS: PAPER II

TIME: 3 HOURS   TOTAL: 150 MARKS

EXAMINER: J. KINSEY   MODERATOR: V. GOVENDER

Name:_____   Teacher's name:_____

READ THE FOLLOWING INSTRUCTIONS CAREFULLY:

1.   This question paper consists of **12 pages.**
2.   There are **2 diagram sheets** included.

        Diagram sheet 1 must be handed in with **Section A** and **Diagram sheet 2** must be handed in with **Section C**

3.   A formula sheet has been provided.
4.   There are **5 sections**. Start each section on a new sheet of paper.
5.   Write your name and Mathematics teacher's name on each sheet and hand in each section separately.
6.   Answer all the questions.
7.   Number your answers as the questions are numbered.
8.   Diagrams are not necessarily drawn to scale
9.   All the necessary working details must be clearly shown.
10.   Approved non-programmable calculators may be used except where otherwise stated.
11.   It is in your own interest to write legibly and to present your work neatly.
12.   Where necessary, **round off to one decimal digit**.
13.   Ensure your calculator is in DEGREE mode.

SECTION A

QUESTION 1

(a)   What would the gradient of the straight line y = mx + c be if it was:

   (1)   Parallel to the line 2y = -3x - 6   (3)

   (2)   Perpendicular to the line 3y = -2x - 6   (3)

(b)   M (a; 2) is the midpoint of A (-2; 5) and B (8; -1). find the value of a   (2)

(c)   Find e if the distance between the points (0 ; -4) and (e ; 0) is 5   (3)

(d)   The point (t sinθ; t cosθ) lies on the circle x^2 + y^2 = 12.   (3)
      Find the value of t where t >0 (leave your answer in surd form if necessary)

(e)   Refer to the figure:

      x + 2y = 6 and y = 3x – 1 make angles of θ and Ø respectively with the x axis.
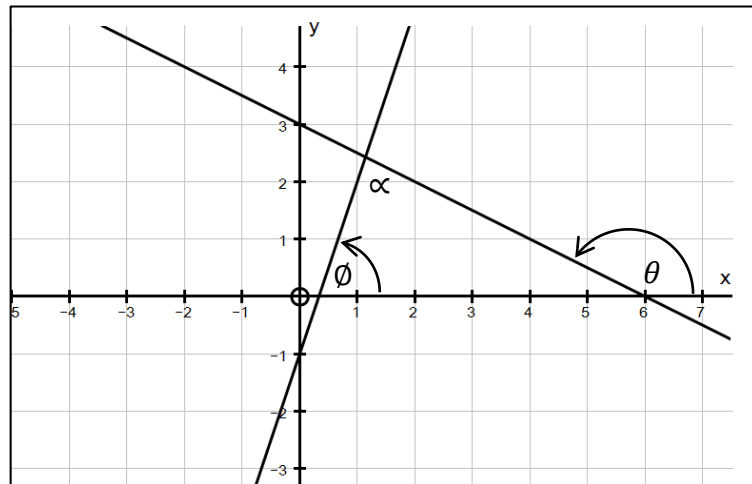
   (1)   Write down the values of tan θ and tanØ   (2)

   (2)   If the acute angle $\propto$ lies between the two lines, find the size of $\propto$ (2)

                                                                        [18]

QUESTION 2

Girls from two matric classes were randomly chosen to have their pulse rate (in beats per minute) measured.

	Pulse rate (beats/minute)														
12 L	67	60	80	78	50	57	72	78	87	90	75	89	65	59	68
12 K	56	64	92	76	72	58	62	65	65	71	87	82	76	75	74

Answer this question on the diagram sheet 1 and hand it in with Section A

(a)   Draw a box-whisker diagram for each class, separately on the grid provided.   (5)

(b)   Determine the interquartile range for 12L   (1)

(c)   Calculate the mean pulse rate and standard deviation of all 30 girls.   (3)

(d)   What percentage of girls pulse rates lie within one standard deviation from the mean   (3)

[12]

SECTION B

QUESTION 3

Virgin Active Gym, Kloof is tying to decide which of two weight loss exercise programmes it will run for its clients.

The gym conducts a pilot study with Programme A and Programme B to investigate the weight lost by 60 women in each programme.

The cumulative frequency graph below is drawn against the weight lost by each woman in the two groups over the course of a month.
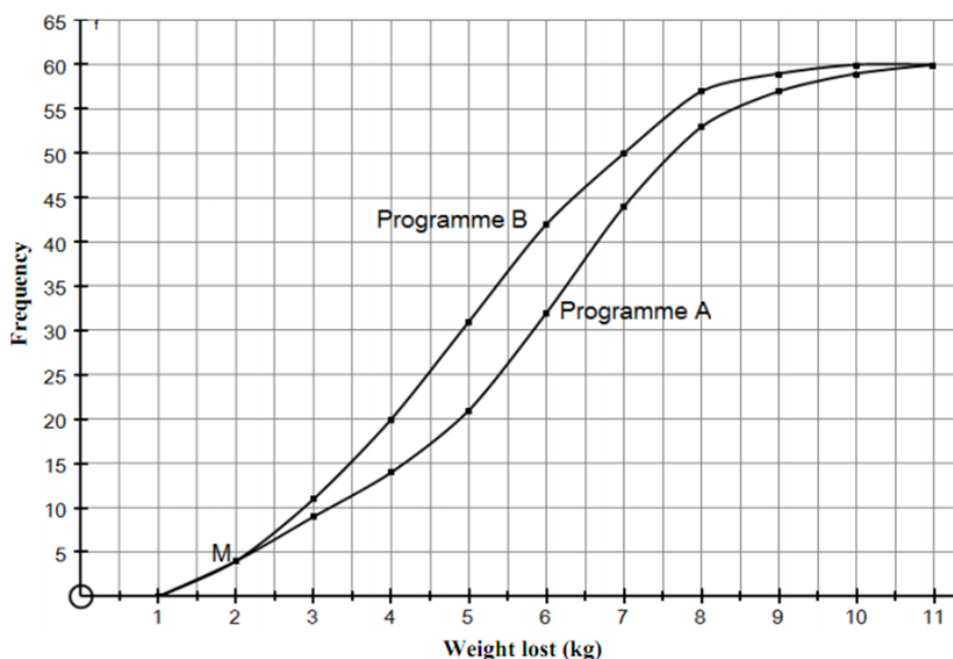
Use the graph to answer the following questions.

(a) How much weight did each of the four women at point M lose?   (1)

(b) Estimate the median weight loss of Programme A   (2)

(c) Estimate the lower quartile of Programme B   (2)

(d) Estimate how many women lost more than 6kgs on Programme B   (2)

(e) In which programme did a greater number of women lose more than 8kg in   (2)
     the month?

(f) Write a brief statement discussing which programme is more successful.   (3)
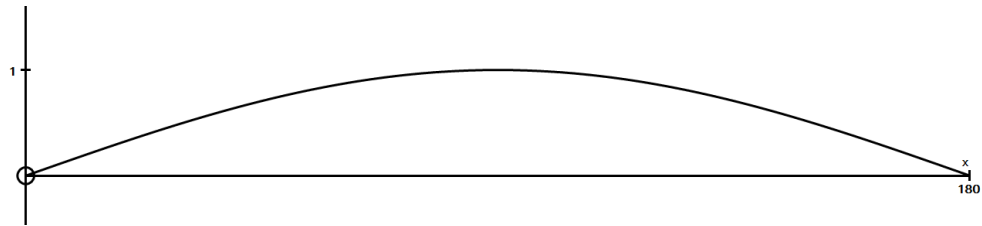   Justify your claims.

                                                                                    [12]

QUESTION 4

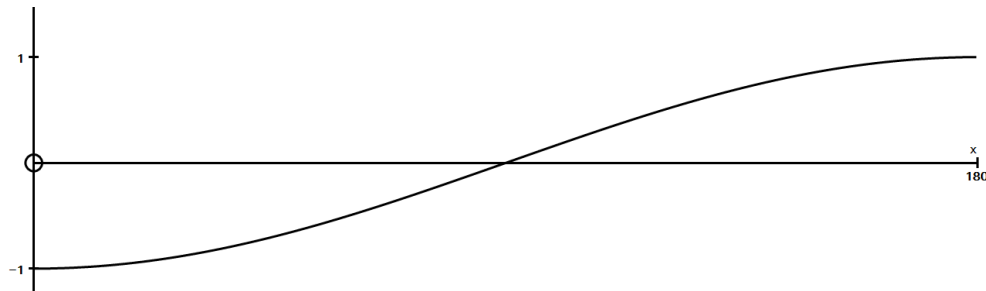The four graphs below are drawn for the interval [0° ; 180°] and have the following equations:

A: y = - cos x ;   B: y = ½ sin 2x ;   C: y = -cos2x ;   D: y = sin x

Match each of the equations with one of the graphs below. Write down the equation of the graph.

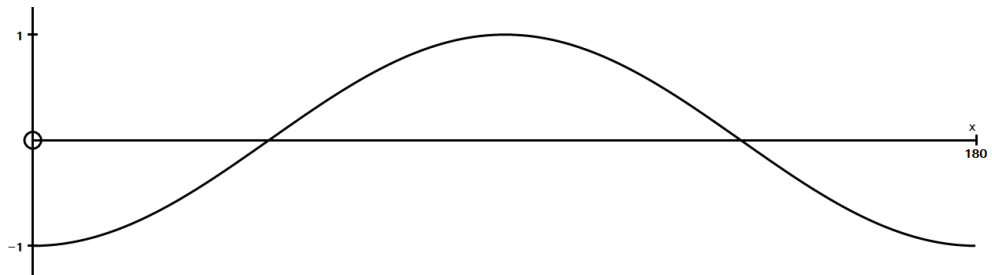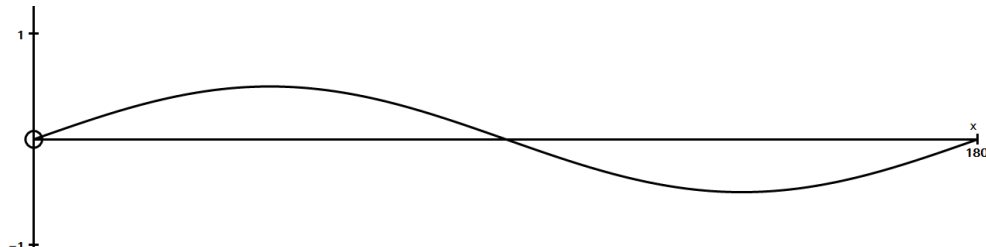(a)

(b)
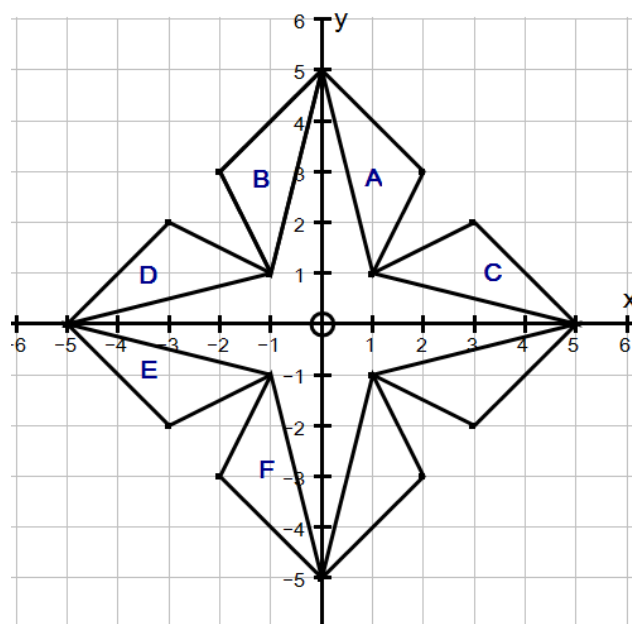
(c)

(d)

(4)

(b)   If tan θ = 1,5 and $90° < \theta < 360°$ calculate the value of sin θ, without the use of a calculator.   (3)

(c)   If sin 32° = t, determine the following in terms of t:

    (1)   Sin 212°   (2)

    (2)   Cos 64°   (2)

    (3)   Cos 77°   (2)

(d)   Solve for θ, rounded to one decimal digit if:
$\cos\theta = \sqrt{5} - 2$ and $\theta \in [180° ; 360°]$ (3)

(e)   Simplify as far as possible: $\dfrac{\cos(90-\theta)}{4\sin(360-2\theta)}$ (3)
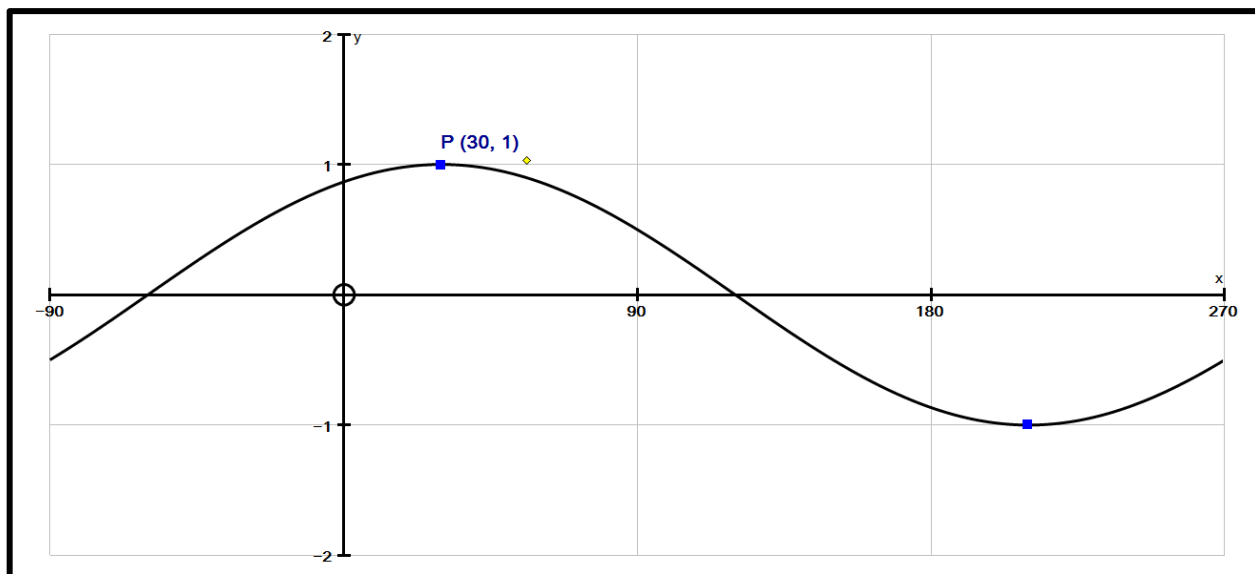
[19]

QUESTION 5

Refer to the diagram below:

Give the rule for the single transformation [e.g. $(x ; y) \to (y ; x)$] that maps the following:

    (a)   A onto B
    (b)   A onto C
    (c)   A onto E
    (d)   A onto F   [4]

SECTION C

QUESTION 6

In the accompanying figure the graph of f(x) = sin(x + θ) is drawn
where -90° < x < 270°

P (30, 1)

(a) Determine the value of θ. (2)

(b) Give the range of f(x) (2)

(c) What is the period of the graph f(x) (1)

(d) Sketch the graph of g where g(x) = 2cos x , where $x \in (-90°; 270°)$. (3)
Use the grid on the diagram sheet 2. (Figure 1)

(e) Assume that the curves of *f* and *g* intersect at 66,2° and 246,2°.
Use your sketch to solve for x in the following:

(1)   sin(x + θ)> 2cos x ;   where $x \in (-90°; 270°)$ (2)

(2)   f(x).g(x) > 0;   where $x \in (-90°; 270°)$ (3)

(f) If the x-axis is shifted down by 2 units what is the new equation of g? (2)

[15]

QUESTION 7

Below is an image of a snowflake set on a Cartesian axes. The centre of the snowflake has been placed at the origin. You may assume the snowflake is perfectly symmetrical.
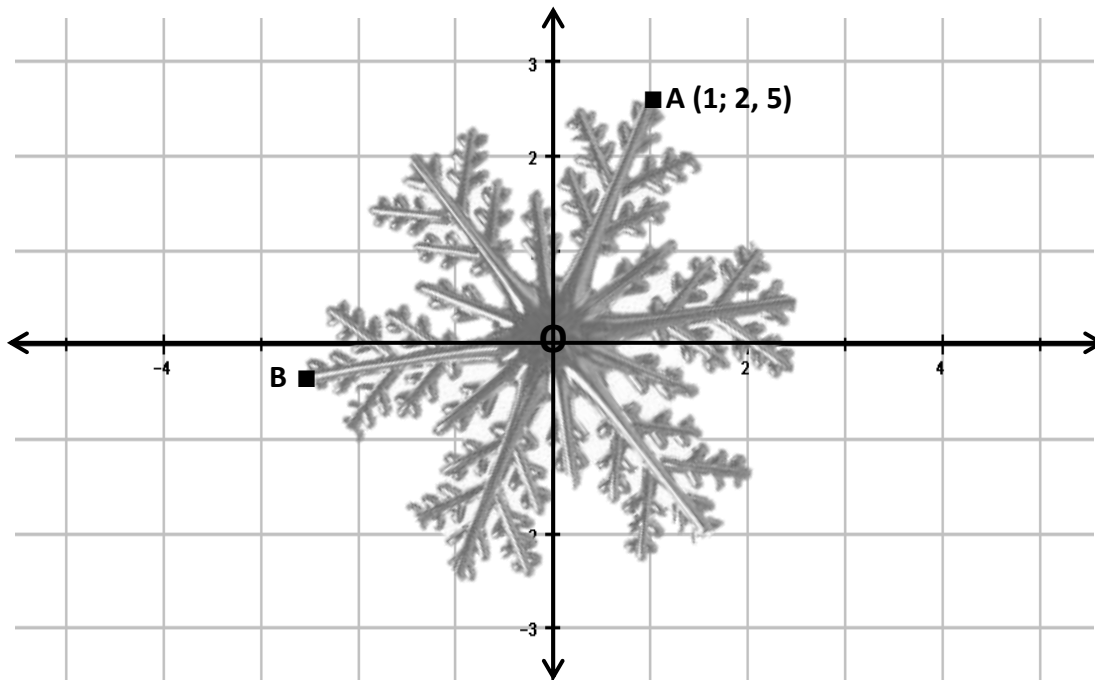
(a)   Determine the angle of inclination of line OA, where O is the origin   (2)
        Give this answer correct to 1 decimal place

(b)   Calculate the co-ordinates of point B, as represented in the diagram above   (5)

(c)   How many axes of reflection exist in the showflake?   (2)

(d)   Below is a diagram that shows the snowflake as a regular hexagon
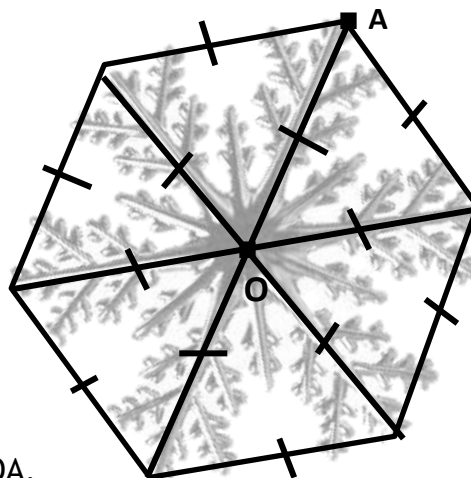
(1)   Determine the length of OA.   (2)

(2)   Hence, or otherwise, determine the area of the hexagon that contains   (3)
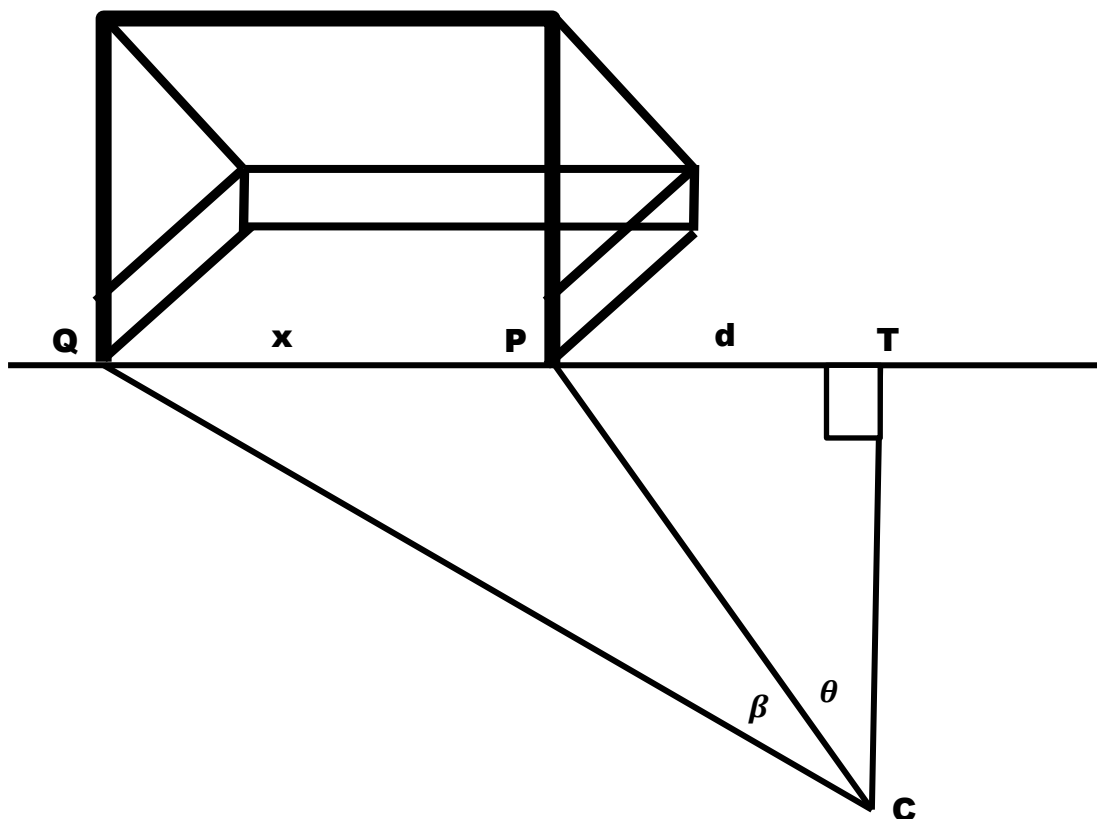   the snowflake.

[14]

SECTION D

QUESTION 8

In a hockey match, St Mary's first team player, Mia, dribbles the ball towards the goal along the baseline to point T.

Mia then passes it to Khanyi who is standing at C.

TC is perpendicular to TP.

In the diagram TP = d, PQ = x and $T\hat{C}P = \theta$ and $Q\hat{C}P = \beta$

(a)   Determine an expression for angle $C\hat{P}Q$ in terms of θ (2)

(b)   Prove: $\sin \beta = \dfrac{x \cos(\theta + \beta)}{CP}$ (4)

[6]

QUESTION 9

    (a)   Determine general solution of :   (6)

$$Cos\ 54°.cosx + sin\ 54°.sin\ x = sin\ 2x$$

    (b)   Given: $\dfrac{2sinx.cosx+2cosx-2cos^3x}{1+sinx} = 2sinx.cosx$

        (1)   Prove the identity above.   (5)

        (2)   For which value of x is the above identity undefined,
                in the interval [-360° ; 360°]   (3)

    (c)   (5)

        (1)   Show that $cos\ 3A = 4\ cos^3A - 3\ cos\ A$

        (2)   It is further given that $1 - sin^2 17° = k$.

                Hence or otherwise, determine $cos\ 51^o$ in terms of k.   (5)

                                                                                             [24]

SECTION E

QUESTION 10

(a) A pen stand made of wood is in the shape of a rectangular prism with four conical depressions to hold pens.
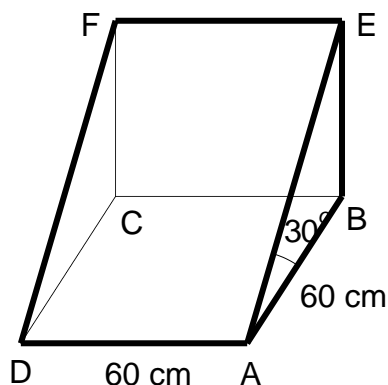
$V = \frac{1}{3}\pi r^2 \times height$
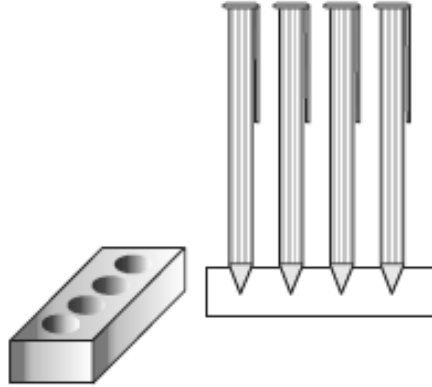
The dimensions of the rectangular prism are 15 cm X 10 cm X 3,5 cm.
The radius of each depression is 0,5 cm and its depth is 1,4 cm.

Determine the volume of wood required for the stand. (5)

(b) A door-stop is in the shape of a prism as represented in the diagram.

EF and FC are perpendicular to plane ABCD. AB = AD = 60 cm.

Calculate the size of the angle that the line DE makes with the plane ABCD. (6)

[11]

QUESTION 11

(a) $C\left(\dfrac{1}{2}; -\dfrac{1}{2}\right)$ is the midpoint of the line joining A (a; 4) and B (3; b).

Determine the area of the triangle formed by the lines AB, y = b and x = a. (5)

(b) The figure shows the cross section of a wheel bearing.

The smaller circles represent ball bearings which roll between the two larger concentric circles, A and B which both have centre M.

The equation of the circle A is given by $x^2 + y^2 + 3x - 6y = 9$.

P is the centre of one of the small ball-bearings, each of which has a radius of 2 units.
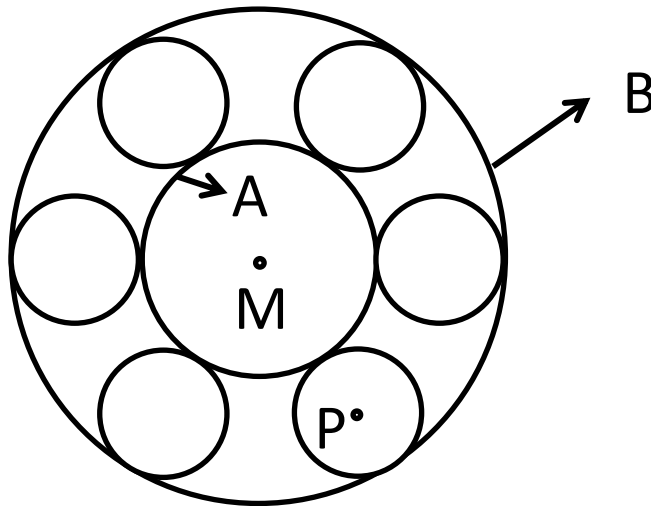
(1) Find the centre of the circles, M. (4)

(2) Determine the length of the radius MP. (2)

(3) Find the equation which describes the path of P as it rolls between the two larger circles.

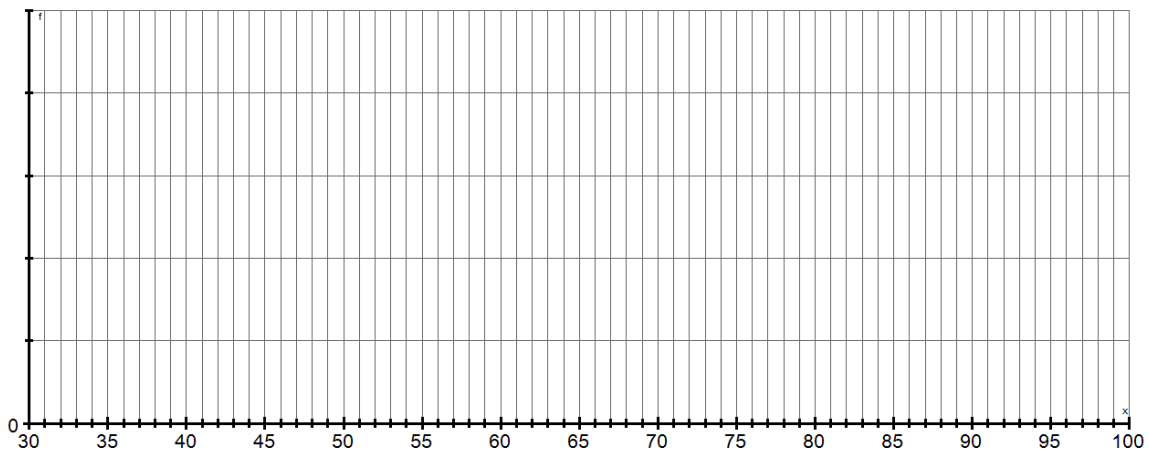Give the answer in the form $(x - a)^2 + (y - b)^2 = r^2$ (4)

[15]

Name:_____   Teacher's name:_____

Diagram Sheet 1
Hand this sheet in with section A

Question 2

(a)   Draw a box-whisker diagram for each class, separately, on the grid below.   (5)

	Pulse rate (beats/minute)														
12 L	67	60	80	78	50	57	72	78	87	90	75	89	65	59	68
12 K	56	64	92	76	72	58	62	65	65	71	87	82	76	75	74

(b)   Determine the interquartile range for 12L   (1)

_____

(c)   Calculate the mean pulse rate and standard deviation of all 30 girls.   (3)

_____

_____

(d)   What percentage of girls pulse rates lie within one standard deviation from   (3)
        the mean

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[12]

Name:_____ **Teacher's name:**_____

Diagram Sheet 2

Hand in this sheet with Section C.

Figure 1