

Actual Test Questions

3rd year Maths

Higher

Christmas 2012

Ms McMenamin

Please answer all questions

Show all your work, marks lost otherwise

Hand this page up also

1. (a) ✍ The perimeter of a rectangle is 200 cm. If the length : breadth = 3 : 2, find the area of the rectangle.

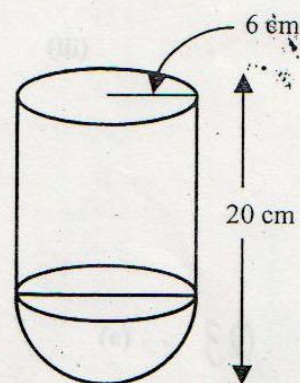
- (b) A solid cone has a vertical height 6 cm. The slant height is 7.5 cm.

- (i) ✍ Find the radius of its base.
(ii) ✍ Find the total surface area in cm^2 .

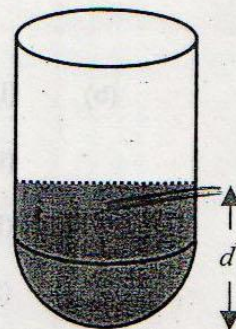
Give your answer correct to three significant figures.

- (c) (i) A container is in the shape of a cylinder on top of a hemisphere as shown. The cylinder has a radius of 6 cm and the container has a height of 20 cm.

- ✍ Calculate the volume of the container in terms of π .



- (ii) One third of the volume of the container is filled with water.
✍ Calculate, d , the depth of the water in the container.



Q2 (a)

The temperature on Sunday is x° .

The temperature rose by 3° each day for the next two days.

The temperature then dropped by 4° each day for the next three days.



✍ Derive an expression in x for the temperature on the fifth day (i.e. Friday).

(b) Let f be the function $f: x \rightarrow 35x - 5x^2$.

Draw the graph of f for $0 \leq x \leq 7$, $x \in \mathbf{R}$.

(c) The formula for the height, y metres, of a ball above ground level, x seconds after it is fired vertically into the air, is given by:

$$y = 35x - 5x^2.$$

Use your graph from part (b) to estimate:

(i) ✍ the maximum height reached by the ball

(ii) ✍ the height of the ball after 5.5 seconds.

On two occasions the ball is 20 metres above the ground.

(iii) ✍ Use your graph from part (b) to estimate the two times when this occurred.

Q3 (a)

Given that:

$$v^2 = u^2 + 2as.$$

✍ Write s in terms of v , u and a .

(b) (i) ✍ Factorise $2l - kl + km - 2m$.

(ii) Factorise $6x^2 - 19x + 10$.

(iii) Factorise $17x - 5x^2$.

(iv) ✍ Simplify $[(2x-1)^2] - [(x-1)^2]$

- (c) (i) ✍ Express in its simplest form: / write as a single fraction

$$\frac{1}{x-1} + \frac{1}{x+1}$$

- (ii) ✍ Hence, or otherwise, solve the equation:

$$\frac{1}{x-1} + \frac{1}{x+1} = 3.$$

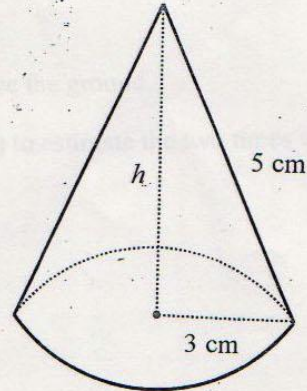
Express your answer in the form $a \pm b\sqrt{10}$, where $a, b \in \mathbb{Q}$.

- Q4 (c) Let f be the function $f: x \rightarrow 1 - 3x$ and g be the function $g: x \rightarrow 1 - x^2$.

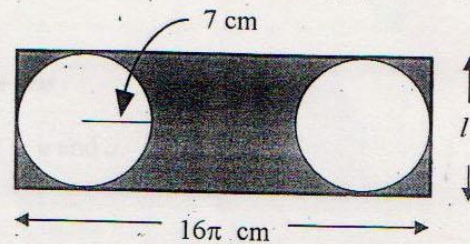
- (i) ✍ Find $f(-2)$ and $g(5)$.
- (ii) ✍ Express $f(x+1)$ in the form $ax + b$, a and $b \in \mathbb{Z}$.
- (iii) ✍ Solve for x : $f(x+1) = f(-2) + g(5)$.

A cone has a base radius of 3 cm and a slant height of 5 cm.

- (i) ✍ Find h , the perpendicular height of the cone.
- (ii) ✍ Find the volume of the cone in terms of π .



- (c) A rectangular piece of metal has a width of 16π cm. Two circular pieces, each of radius 7 cm, are cut from the rectangular piece, as shown.



- (i) Find the length, l , of the rectangular piece of metal.

(ii) ✍ Calculate the area of the metal not used (i.e. the shaded section), giving your answer in terms of π .

(iii) ✍ Express the area of the metal not used as a percentage of the total area

Q5 (a)(i) On a diagram, show the triangle ABC , where A is $(-4, 1)$, B is $(-2, 5)$ and C is $(6, 1)$.

(ii) Find D , the midpoint of $[AC]$, and label this point on the diagram.

(iii) Hence, construct on the diagram the circle with diameter $[AC]$, use a compass if you can.

(iv) Show that angle $\angle ABC$ is a right angle. (perpendicular)

(b) l is the line $3x - 4y - 15 = 0$.

(i) Verify that $(1, -3)$ is a point on l .

(ii) l intersects the x -axis at P . Find the co-ordinates of P .

The line k passes through the point $(1, -3)$ and is perpendicular to l .

(iii) Show the lines l and k on a co-ordinate diagram.

(iv) Find the equation of k .

(v) Write down the point of intersection of k and l from your diagram in (iii)

(vi) Verify this point of intersection by doing simultaneous equations.

* Don't forget formula on pg 18 of Log tables