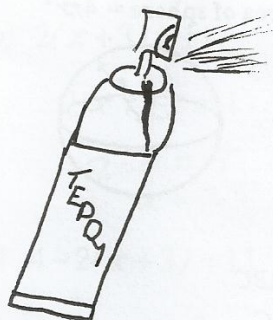# KCS Mathematics Department

4th Form

Paper 1 (Non-Calculator)

June 2006

1½ hours

Instructions

1. Write your name in the space below and circle the initials of your teacher
2. Answer ALL Questions
3. Show all necessary working
4. Write your answers in the spaces provided
5. Where appropriate give answers to three significant figures
6. Calculators may NOT be used
7. There are 100 marks in total

Name: ...Teddy Hawkins-Hooker...........................

Teacher:

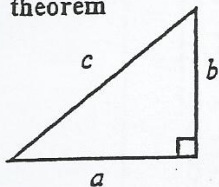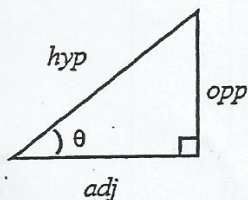|			
JA	BJD	KNH	TPH
DRK	GMG	SJN	RJP
MPS	CJT	SUW	

Appendix two – formulae sheet for Higher Tier

Pythagoras' theorem

$$a^2 + b^2 = c^2$$

Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$
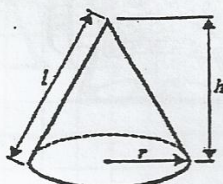
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$
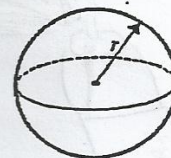
$$adj = hyp \times \cos \theta$$
$$opp = hyp \times \sin \theta$$
$$opp = adj \times \tan \theta$$

or

$$\sin \theta = \frac{opp}{hyp}$$

$$\cos \theta = \frac{adj}{hyp}$$

$$\tan \theta = \frac{opp}{adj}$$

In any triangle ABC
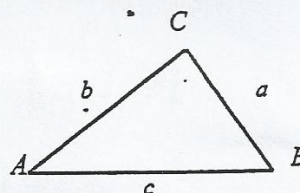
Sine Rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine Rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle $= \frac{1}{2}ab \sin C$
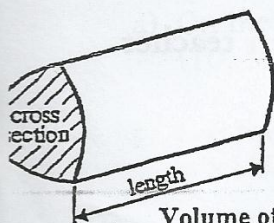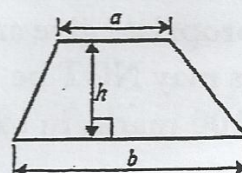
Volume of prism = area of cross section × length

Area of trapezium $= \frac{1}{2}(a+b)h$

Circumference of circle $= 2\pi r$

Area of circle $= \pi r^2$
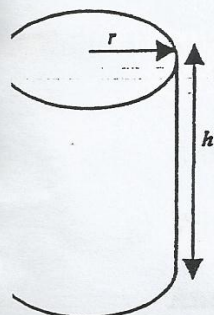
Volume of cylinder $= \pi r^2 h$

Curved surface area of cylinder $= 2\pi r h$

The quadratic equation
The solutions of $ax^2 + bx + c = 0$
where a $\neq$ 0, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2

1) Solve the equations

a) $2x + 3 = 11$

-3

$2x = 8$

$x = 4$

Ans.....$x = 4$........[2]

b) $2(x + 3) = 11$

$2x + 6 = 11$

$-6 \quad -6$

$2x = 5$

$x = 2.5$

Ans.....$\dfrac{5}{2}$.......[4]

c) $4 - 2(x + 3) = 11$

$4 - 2x + 6 = 11 + 2x$

$+2x$

10

$13 = 2x$

$x = 6.5$

Ans.....$-\dfrac{13}{2}$.......[5]

d) $\dfrac{2x + 3}{5 \times 5} = 11 \times 5$

$2x + 3 = 55$

$-3 \quad -3$

$2x = 52$

$x = 26$
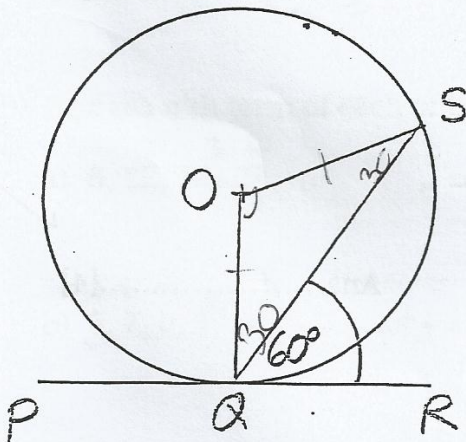
Ans.....$x = 26$.......[4]

2) In the diagram, O is the centre of the circle, PQR is the tangent at Q and S is a point on the circumference. Angle SQR is 60°. Find the size of angle SOQ.

Ans.....120.........[3]

3

3) Expand the brackets and simplify:

a) $4t(t^2 - 1) - 2t^2(2t - 3)$

$4t^3 - 4t - 4t^3 - 6t^2$

$6t^2 - 4t$

Ans....$-4t + 6t^2$........[4] ✗

b) $(p + 2)(p - 7)$

$p^2 - 7p + 2p - 14$

$p^2 - 5p - 14$

Ans.....................[3] ✓

c) $(2q - 3)(2q + 3)$

$4q^2 + 6q - 9 - 6q$

$4q^2 - 9$

Ans.....................[3] ✓

4) Find the equations of the lines

a) through (0, 4) with gradient 2

$y = mx + c$

$y = 2(0) + c$

$y = 0 + c$

$4 = 2(0) + 4$

Ans.....................[3] ✓

b) through (12, 0) and (6, 3)

$y = mx + c$

gradient   y intercept

Ans.....................[5]

5) Solve the pairs of simultaneous equations:

a) $3x + y = 20,\ 5x - y = 36$

$8x = 56$

$x = 7$

$21 + y = 20$

$y = -1$

Ans.....................[4] ✓

b) $3x + 8y = 14,\ 7x - 9y = 5$

$21x - 27y = 15$

$21x + 84y = 98$

$111y = 113$

$83x = 113$

$x = 1.4$

Ans.....................[6] ✗

4

6) Factorize:

   a) $x^2 + 8x + 12$

   $x + 4(x + 2 + 3)$

   Ans...................[3]

   b) $x^2 - x - 20$

   $x(x - 20)$

   Ans...................[2]

   c) $x^2 - 25$

   $x(x - 25)$

   Ans...................[2]

   d) $ac - bd + bc - ad$

   $a(c - d) + b(c - d) = (a + b)(c - d)$

   Ans...................[4]

7) Find the volume of a cone of radius 4 and height 3, *leaving your answer as a multiple of* π.

   $\frac{1}{3}\pi r^2 h$ $\frac{1}{3} \times \pi \times 16 \times 3 = 50.3$

   Ans.........16π.........[3]

8) The volume of a sphere is numerically equal to its surface area. What is the radius of the sphere?

   $V = \frac{4}{3}\pi r^3$ $r^3 = 3r^2$

   $Sa = 4\pi r^2$ $\frac{r^3}{3} = r^2$ $r = 3$

   $r = 3$

   Ans.........$r = 3$.........[4]

9) Find the n'th term of each of the sequences:

   a) $\overset{1}{8}, \overset{2}{12}, \overset{3}{16}, \overset{4}{20}, \ldots$ $\times 4 + 4$

   $4N + 4$

   Ans...................[3]

   b) $\overset{1}{9}, \overset{2}{7}, \overset{3}{5}, \overset{4}{3}, \ldots$ $-2n + 11$

   Ans...................[3]

TURN OVER

5

10) 1000 people were checked at an A & E unit for the amount of time they spent at the hospital. The results are shown in the cumulative frequency diagram below:
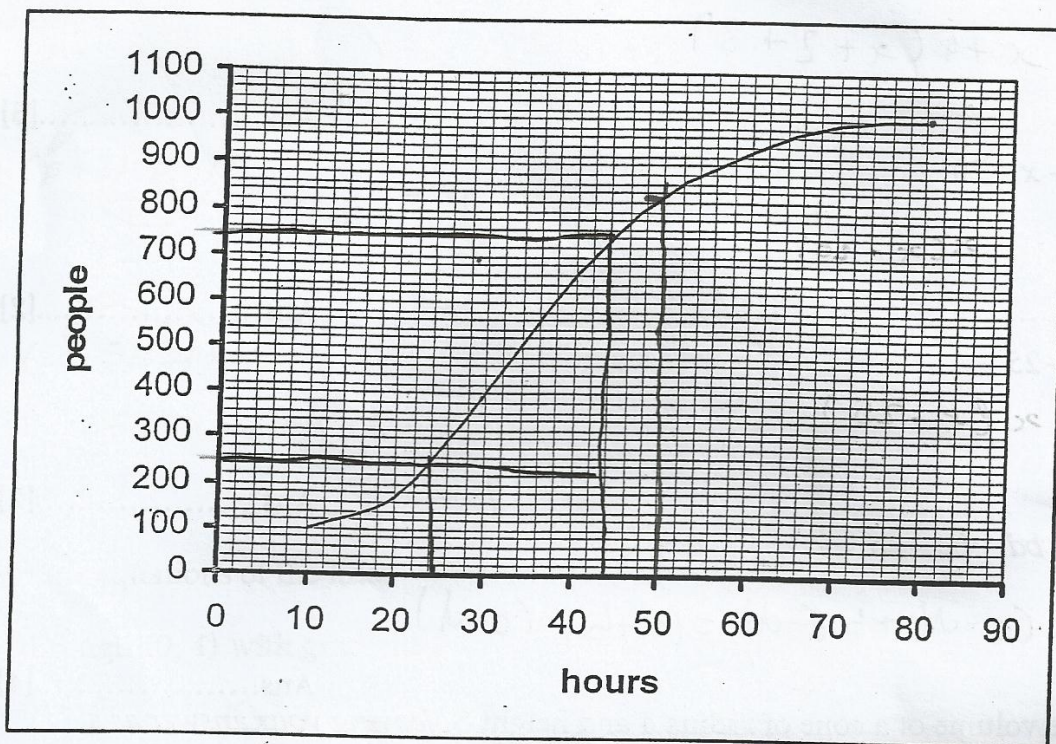
Use the diagram to estimate the median time and the inter-quartile range.

$\frac{a+f}{2}$

$Q_1 = \frac{n \, total}{4}$ $Q_3 = \frac{n \, total}{4} \times 3$
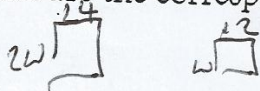
Ans Median = ...[2]

Ans IQR = ...[2]

a) How many patients spent more than 50 hours in the hospital?

Ans.........190...........[2]

11) Two boxes of brazils are mathematically similar. their lengths are 12 cm and 24 cm. The surface area and volume of the smaller box are 250 cm² and 240 cm³ respectively. What are the corresponding figures for the larger box?
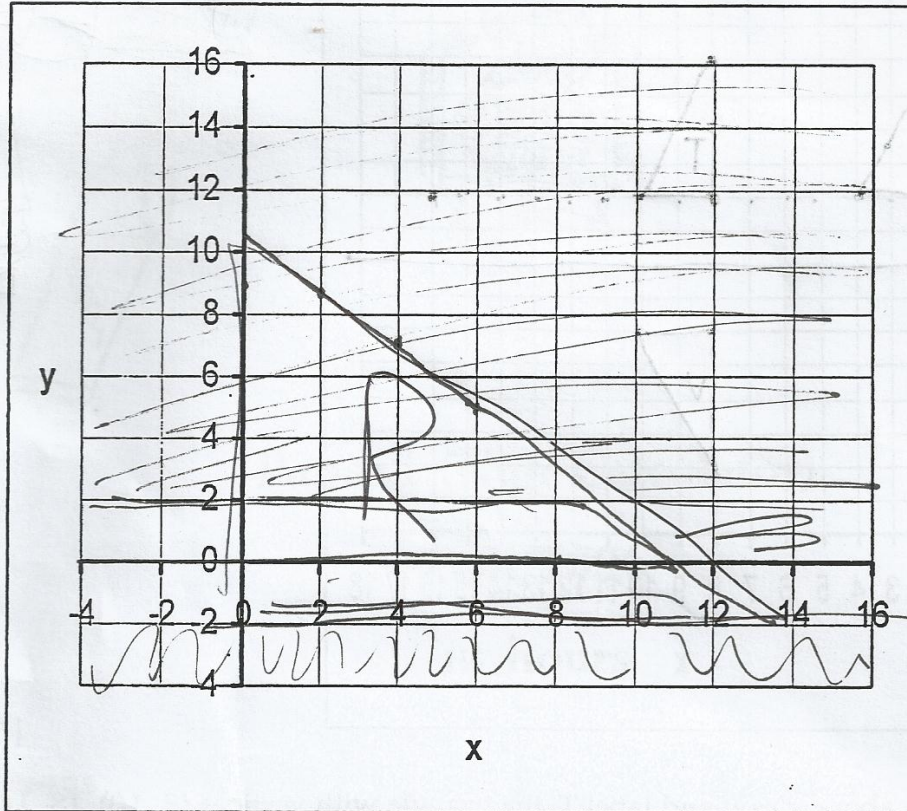
$k = 2$

$k^2 = 4$

$k^3 = 8$

Ans Area = ...[4]

Ans Volume = ...[2]

6

12)
a) On the axes below, illustrate, by shading, the region defined by the three inequalities

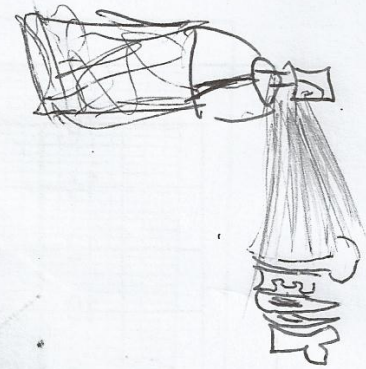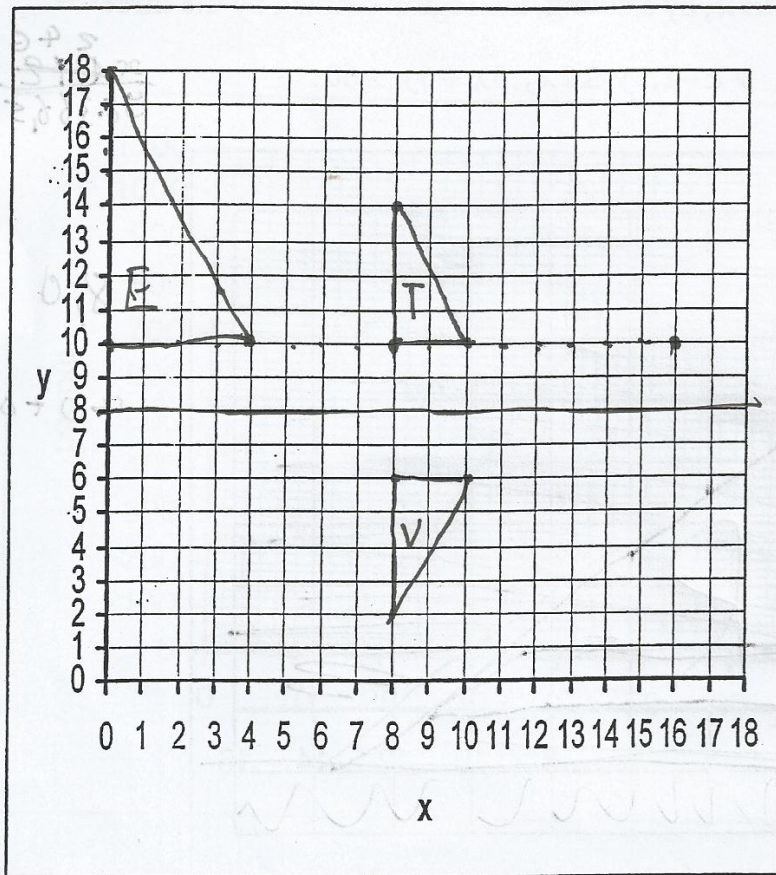$$y \geq -2, \quad y \leq 2x, \quad 5x + 6y \leq 60.$$

[4]

b) Find, by calculation, the exact co-ordinates of the point in the region at which y is greatest.

Ans.....................[5]

TURN OVER

13)

[5]

a) On the axes above, draw and label T, the triangle with vertices (8, 10), (8, 14), (10, 10).

b) U is the image of T after a rotation of 90˚ anticlockwise, centre (8, 8). Draw and label U.

c) V is the image of T after reflection in the line y = 8. Draw and label V.

d) W is the image of T after a rotation of 90˚ anticlockwise, centre (12, 12). Draw and label W.

e) E is the image of T after an enlargement, scale factor 2, centre (16, 10). Draw and label E.

f) What is the single transformation that maps U onto W?

Ans..[2]

g) What is the single transformation that maps U onto V?

Ans..[2]

THE END

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