

# KCS Mathematics Department



$\frac{40}{77} = 52\%$

## 4<sup>th</sup> Form Paper 2 (Calculator)

June 2012

1½ hours

### Instructions

- Write your name in the space below and circle the initials of your teacher
- Answer ALL Questions
- Show all necessary working
- Write your answers in the spaces provided
- Where appropriate give answers to three significant figures
- Calculators may be used
- There are 77 marks in total

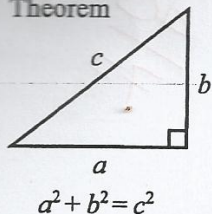
Name: ..... *Hawkins - Hooper* .....

Teacher:    HB                    SMB                    BJD                    KNH  
                  TPH                    GDK                    GMCG                    SJN  
                  AJP                    MPS                    TRS                    SUW



**IGCSE MATHEMATICS  
FORMULAE SHEET – HIGHER TIER**

Pythagoras' Theorem

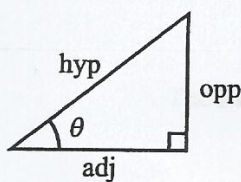
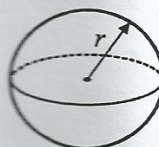
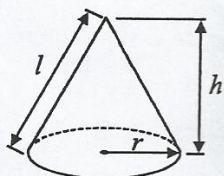


Volume of cone =  $\frac{1}{3} \pi r^2 h$

Volume of sphere =  $\frac{4}{3} \pi r^3$

Curved surface area of cone =  $\pi r l$

Surface area of sphere =  $4 \pi r^2$



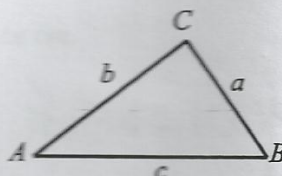
adj = hyp  $\times$  cos  $\theta$   
opp = hyp  $\times$  sin  $\theta$   
opp = adj  $\times$  tan  $\theta$

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

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

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

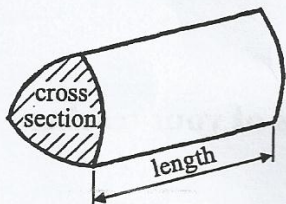
In any triangle ABC



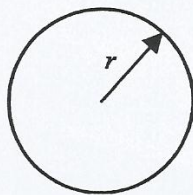
Sine rule:  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

Area of triangle =  $\frac{1}{2} ab \sin C$



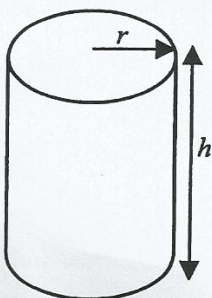
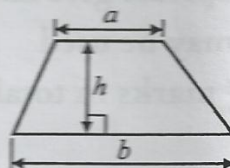
Volume of prism = area of cross section  $\times$  length



Circumference of circle =  $2 \pi r$

Area of circle =  $\pi r^2$

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



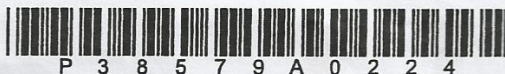
Volume of cylinder =  $\pi r^2 h$

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

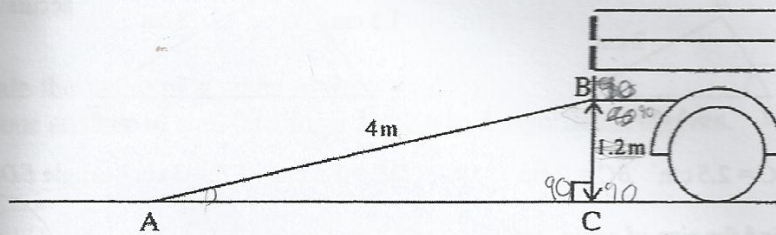
The Quadratic Equation

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

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







A ramp AB, 4 metres long, is attached to the back of a lorry at a point, B, 1.2 metres above the ground.

(a) Calculate the distance AC.

$$1.2^2 + b^2 = 4^2$$

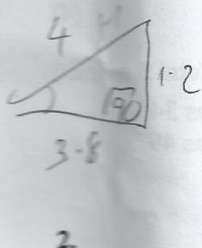
$$1.44 + b^2 = 16$$

$$b^2 = 14.56$$

Answer 3.82 m [3]

(2)

(b) Calculate the angle that the ramp makes with the ground.



~~SOH CAH TOA~~

SOH CAH TOA

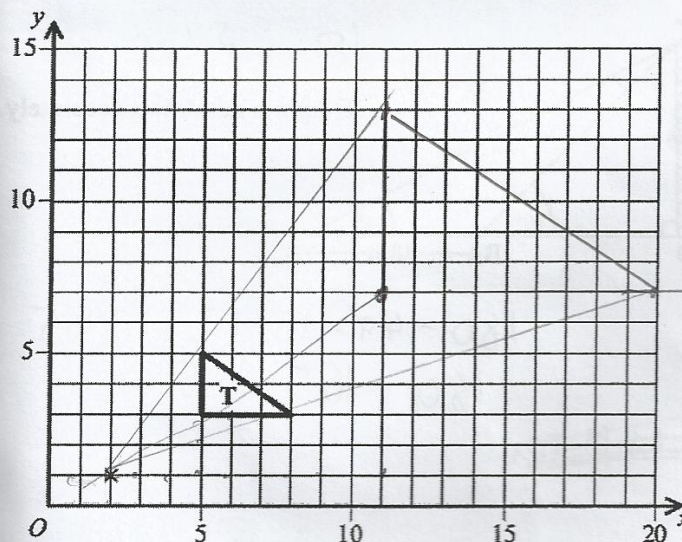
~~sin 90 = 4~~

$$c = \frac{a}{\sin}$$

$$\sin(\theta) = \frac{1.2}{4}$$

Answer 17.36 ° [3]

x \*



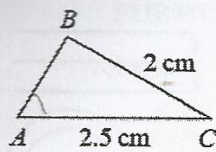
On the grid, enlarge triangle T with a scale factor of 3 and centre (2, 1).

(Total 3 marks)

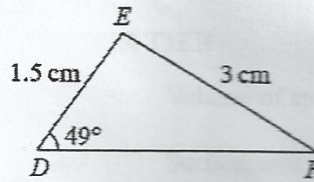
(3)



3. Triangles  $ABC$  and  $DEF$  are similar.



$AC = 2.5 \text{ cm}$   $BC = 2 \text{ cm}$



$DE = 1.5 \text{ cm}$   $EF = 3 \text{ cm}$  Angle  $EDF = 49^\circ$

Diagrams NOT accurately drawn

(a) Find the size of angle  $BAC$ .

~~SOM LATER~~

$$\frac{3}{2} = \frac{49}{x}$$

$$98 = 3x = 326 \quad (1)$$

$49^\circ$   
 $326^\circ$

(b) Work out the length of

(i)  $DF$ ,  $\frac{3}{2} = \frac{x}{2.5}$   $2x = 7.5$   $x = 3.75$

$3.75 \text{ cm}$

(ii)  $AB$ ,  $\frac{3}{2} = \frac{1.5}{x}$

$$3x = 3 \quad x = 1$$

$1 \text{ cm}$   
(4)

(Total 5 marks)

4. At A, Bob measures the angle of elevation of the top of a building as  $34^\circ$ .  
At B, 18 m nearer the building, he measures the angle of elevation as  $49^\circ$ .

Calculate the height of the building. angle  $BTA$ .

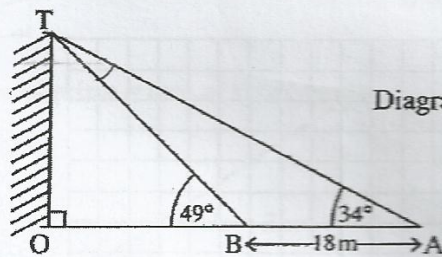


Diagram not drawn accurately

$$180 - 49 = 131 + 34 = 165$$

$$180 - 165 = 15$$

~~SOM LATER~~

(9)

Answer  $15^\circ$  / [5]

5. When you are  $h$  feet above sea level, you can see  $d$  miles to the horizon, where

$$d = \sqrt{\frac{3h}{2}}$$

- (a) Calculate the value of  $d$  when  $h = 8.4 \times 10^3$   
Give your answer in standard form correct to 3 significant figures.

$$\sqrt{\frac{3(8.4 \times 10^3)}{2}} = 112.24$$

$$1.12 \times 10^2$$

$$d = \sqrt{\frac{3 \times 10^6}{2}} = 1224.744871$$
~~$$3 \times 8.4 \times 10^3 = 25.2 \times 10^3 = 25200$$~~

$$25.2 \times 10^3 = 25200$$

$$d = \frac{25200}{\sqrt{2}} = 17800 \approx 1.78 \times 10^4$$
~~$$d = 1.770 \times 10^3$$~~

- (b) Make  $h$  the subject of the formula  $d = \sqrt{\frac{3h}{2}}$

$$d^2 = \frac{3h}{2}$$

$$2d^2 = 3h$$

$$\frac{2d^2}{3} = h$$

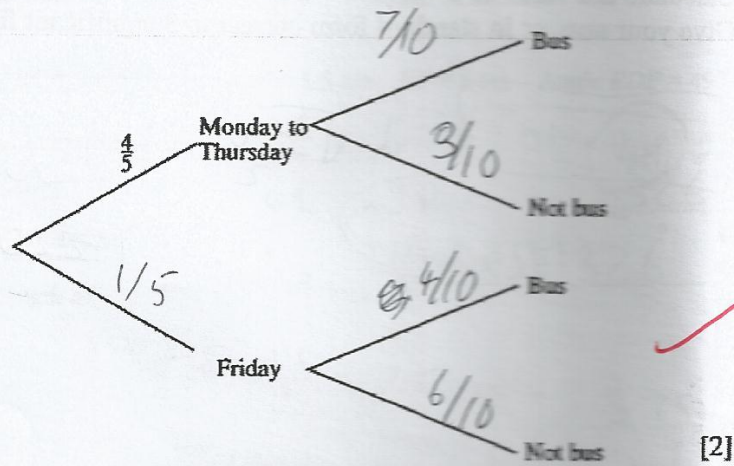
$$h = \frac{2d^2}{3}$$

(Total 4 marks)



6. On Monday to Thursday, the probability that Keith travels home from school by bus is 0.7. On Friday the probability is 0.4.

(a) Complete the tree diagram for Keith's method of travel on a school day chosen at random.



(b) Calculate the probability that, on a school day chosen at random, Keith travels home from school by bus.

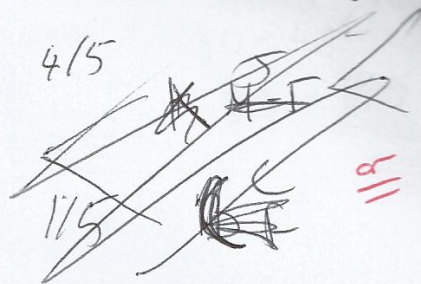
$$\frac{4}{5} \times \frac{7}{10} + \frac{1}{5} \times \frac{4}{10}$$

$$\frac{14}{25} + \frac{2}{25}$$

Answer  $\frac{16}{25}$  [3]

(c) If Keith travels home by bus, the probability that his brother, Colin, also travels home by bus is 0.9.  
If Keith does not travel by bus, the probability that Colin travels home by bus is 0.4.

Calculate the probability that, on a school day chosen at random, only one of the brothers travels home by bus.

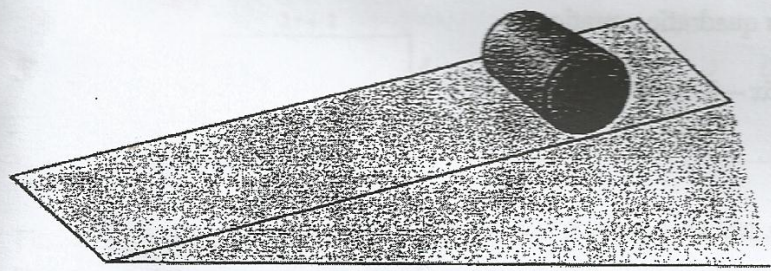


$$\frac{9}{25} \times \frac{4}{10} = \frac{18}{125}$$

Answer  $\frac{18}{125}$  [4]



7.



(a) A cylindrical drum, of diameter 56 cm, is rolled down a slope of length 4.4 metres. 440cm

How many revolutions will it make?

2750

$$\frac{440}{175} = 2.50$$

$$\pi r^2 \times 44$$

440cm

$$r = 28$$

$$440 \div 56 = 7.86$$

Answer 7.86 [3]

(b) The drum is 90 cm long. How many litres would it hold?

$$\pi r^2 h$$

$$\pi \times 28^2 \times 90$$

$$= 221670.7 = 222$$

(3)

Answer 221671 litres [4]



8. Solve this quadratic equation.

$$x^2 - 5x - 8 = 0$$

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

Give your answers correct to 3 significant figures.

~~(x-5)(x-8)~~

~~x-8=0~~

$$\frac{5 \pm \sqrt{25 - 4(1)(-8)}}{2}$$

(x-5)(x-8)

$$\begin{aligned} x-5 &= 0 \\ x &= 5 \end{aligned}$$

$$\begin{aligned} x-8 &= 0 \\ x &= 8 \end{aligned}$$

$$\begin{aligned} &= 6.27 \\ &= -1.27 \end{aligned}$$

x = 6.27 or x = -1.27

(Total 3 marks)

3

9.

$$x = \frac{2y+7}{3y-3x-3}$$

$$\frac{-3(2y+7)}{3y}$$

Make y the subject of the formula.

~~3y(2y+7) = -3(2y+7)~~  
~~-18y^2 + ...~~

$$\frac{-6y + -21}{3y + 3x}$$

$$-6y - 21 = -3(2y+7)$$

$$-6y - 21 = -6y - 21$$

$$y = 10.5$$

Answer y = 10.5 [5]

$$3y - 3(2y+7)$$

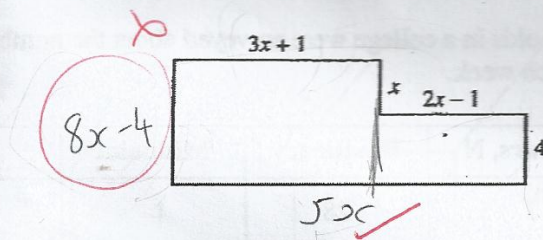
$$x = \frac{6y+21}{-3}$$

$$x = -18y - 63$$

$$\begin{aligned} x &= \frac{6y+21}{-3} \\ -x - 6y &= -2 - 2x \\ -6y &= \frac{-2x}{-6} \end{aligned}$$



10.



(a) Find an expression, in its simplest form, for the perimeter of the shape shown.

$$\begin{aligned}
 & \cancel{5x} + 4 + \cancel{2x-1} + x + 3x + 1 + \cancel{8x-4} \\
 & 7x - 1 \qquad 8x - 5 \qquad 11x - 6 \\
 & 7x - 5 \qquad \text{Answer } \underline{19x - 2} \quad [2]
 \end{aligned}$$

(b) Find an expression, in its simplest form, for the area of the shape shown.

$$\begin{aligned}
 & (2x - 1) \times 4 + (3x + 1) \times (8x - 4) \\
 & 8x - 4 + 24x - 4 \\
 & 32x - 8 \qquad \text{Answer } \underline{32x - 8} \quad [3]
 \end{aligned}$$

(c) Given that the area of the shape is 180 square units. Find the perimeter of the shape.

$$\begin{aligned}
 & 180 = 32x - 8 \\
 & 32x - 8
 \end{aligned}$$

$$188 = 32x$$

$$188 \div 32 = x$$

$$19x - \frac{x}{2} = 5.875$$

$$19 \times 5.875 = 111.625 + \frac{x}{2} =$$

$$\text{Answer } \underline{113.625} \quad [5]$$

$$\begin{aligned}
 x &= 2y + 7 \\
 \hline
 3y &= 3
 \end{aligned}$$

$$\begin{aligned}
 x &= 6y + 21y \\
 \hline
 &= -3
 \end{aligned}$$

$$x = -18y + -63$$

$$x = -81y$$

$$\frac{-8}{81}y = \frac{-x}{81} \quad y = \frac{-x}{81}$$



11. All 15 to 17 year-olds in a college were surveyed about the number of hours exercise taken each week.

Number of hours, N	Frequency	Midpoint	$f \times x$
$0 \leq N < 2$	28	1	28
$2 \leq N < 4$	12	3	36
$4 \leq N < 6$	9	5	45
$6 \leq N < 8$	7	7	49
$8 \leq N < 10$	2	9	18
$10 \leq N < 12$	1	11	11
$12 \leq N < 14$	1	13	13

60

260

- (a) Calculate an estimate for the mean number of hours exercise taken.

$$260 \div 60 = 3.3$$

Answer 3.3 [3]

- (b) In which class interval does the median lie?

Answer  $2 \leq N < 4$  [2]

12. In a football club, 16 players have an average yearly wage of  $\text{£}9.8 \times 10^5$   
 Eight players have an average yearly wage of  $\text{£}1.78 \times 10^6$   
 Calculate the average weekly wage for each of the 24 players.

$$16 \times 9.8 \times 10^5 = 15680000$$

$$8 \times 1.78 \times 10^6 = 14240000$$

$$\underline{15808000}$$

Answer  $\text{£} 1.58 \times 10^7$  [4]



13.

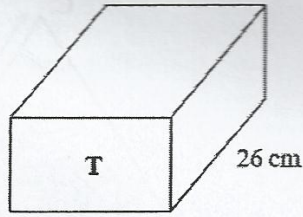
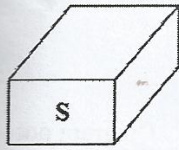


Diagram NOT accurately drawn

Two cuboids, S and T, are mathematically similar.  
The total surface area of cuboid S is  $157 \text{ cm}^2$  and the total surface area of cuboid T is  $2512 \text{ cm}^2$ .

- (a) The length of cuboid T is 26 cm.  
Calculate the length of cuboid S.

$$\begin{aligned} \text{LSF } 16 \\ \text{LSF } 4 \\ \text{VSF } 4^3 = 64 \end{aligned}$$

$$26 \div 4 = 6.5$$

..... 6.5 ..... cm  
(3)

- (b) The volume of cuboid S is  $130 \text{ cm}^3$ .  
Calculate the volume of cuboid T.

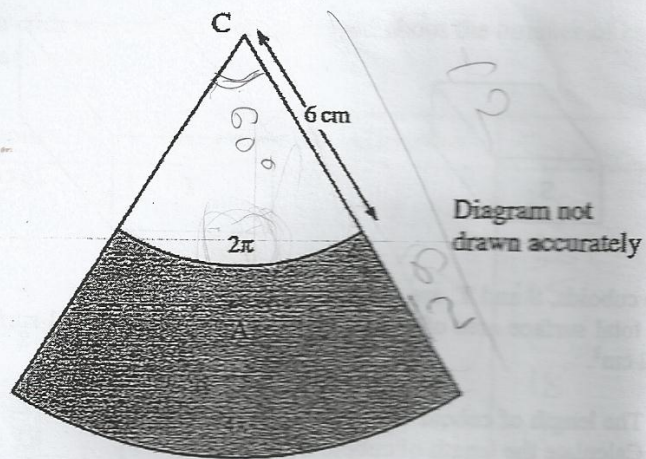
$$130 \times 64 = 8320$$

..... 8320 .....  $\text{cm}^3$   
(2)

(Total 5 marks)



14.



The length of the arc of a circle, centre C, radius 6 cm, is  $2\pi$  cm.

The length of the arc of a larger circle, centre C, is  $4\pi$  cm.

Calculate the shaded area A.

$$\pi r^2 = \pi 6^2 \quad \pi \times 36 = 113.1$$

$$\pi r^2 = \pi 13^2 = 531$$

$$531 - 113 = 418$$

Answer 418  $\text{cm}^2$  [6]

End of Paper

Total Marks (77)