

Mathematics IGCSE Higher Tier, November 2008

4400/3H (Paper 3H)

Link to examining board:

<http://www.edexcel.com>

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Question 1

$$7.9 + 3.8 = 11.7$$

$$8.6 - 2.1 = 6.5$$

$$11.7 \div 6.5 = 1.8$$

This calculation can be done by typing directly into your calculator – but you must remember to put brackets around the numerator and the denominator. I.e $(7.9 + 3.8) \div (8.6 - 2.1)$

Question 2

a) look for something that goes into both terms. This is 7, so 7 comes on the outside of the brackets
 $7(p - 3)$

b) expand the brackets

$$4x + 20 = 12$$

subtract 20 from both sides

$$4x = -8$$

divide both sides by 4

$$x = -2$$



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Question 3

a)

score	frequency	Score x frequency
1	10	$1 \times 10 = 10$
2	9	$2 \times 9 = 18$
3	3	$3 \times 3 = 9$
4	17	$4 \times 17 = 68$
5	11	$5 \times 11 = 55$
total	50	160

Mean score = $\frac{160}{50} = 3.2$ (check that this answer seems sensible given the data that we input as a common mistake is to divide by 5)

b)

i) probability of a score of 4 is $\frac{17}{50}$

ii) probability of a score of 1 or 3 is $\frac{10+3}{50} = \frac{13}{50}$

c) it appears that the spinner is not fair. If it were fair then we would expect the spinner to have landed on each score an equal number of times (roughly).

Question 4

a) triangle P has been mapped onto triangle Q by a vector translation (it has been picked up and moved 7 places to the left and 1 place down without changing the orientation). The vector translation is $\begin{pmatrix} -7 \\ -1 \end{pmatrix}$

b) Triangle P has been mapped onto triangle R by a rotation of 90° in an anti-clockwise direction (or could have said 270° in a clockwise direction) about centre (0,0) (origin)



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Question 5

a) the important thing with percentage questions is to know what the figure they have given you actually represents. The normal price was £180 so this represented 100%. We want to know what 65% (100% – 35% reduction is 65%) is so we divide £180 by 100 (to get 1%) and then multiply up by 65 (to get 65%)

$$\frac{180}{100} \times 65 = \text{£}117$$

b) The reduction is £84 and this represents 35%. The normal price will be 100%. So we divide £84 by 35 (to get 1%) and then multiply by 100

$$\frac{84}{35} \times 100 = \text{£}240$$

c) The sale price (£442) represents 65% and we want the normal price which is 100%. So we divide £442 by 65 (to get 1%) and then multiply up by 100 (to get 100%)

$$\frac{442}{65} \times 100 = \text{£}680$$

Question 6

A cylinder is a prism and we are given the formula of a prism in the formulae sheet

Volume = area of cross section x length

In this case the cross section is a circle and the formula for a circle (also given in formulae sheet) is πr^2

All the measurements given are in cm which makes things a little easier. If there had been a mix of cm and metres for example we would have had to have converted as well.

The radius of the circle is 2.15 (half of 4.3), so the

area of the circle (cross section) = $\pi \times 2.15^2 = 14.52201$ (keep this to several decimal places as we haven't reached the end of the question yet)

Volume = $14.52201 \times 7.6 = 110.367 = 110$ (3 sf)

Question 7

To divide fractions you change the ÷ sign to a x and flip the second fraction over,

$$\frac{2}{5} \div \frac{4}{7} = \frac{2}{5} \times \frac{7}{4} = \frac{1}{5} \times \frac{7}{2} = \frac{7}{10}$$



Question 8

a) i) $p^5 \times p = p^5 \times p^1 = p^{5+1} = p^6$

ii) $q^8 \div q^3 = q^{8-3} = q^5$

b) $12x - 3 - 8x + 12$ (note that this needs to be +12 not -12 as $-4 \times -3 = +12$)

grouping terms

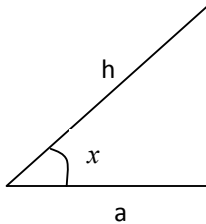
$4x + 9$

c) $(y + 3)(y + 5) = y^2 + 15 + 3y + 5y = y^2 + 8y + 15$

Question 9

The triangle is a right angled triangle so we should always think of Pythagoras or basic trigonometry. In this case we have angles too so it is basic trigonometry (SOHCAHTOA)

Labelling the triangle from the point of view of the angle we have adjacent (a) and hypotenuse (h) so we can use $\cos x = \frac{a}{h}$



$\cos x = \frac{5.4}{8.7}$

take the inverse cos (\cos^{-1}) of both sides

$x = \cos^{-1}\left(\frac{5.4}{8.7}\right) = 51.633 = 51.6$ (1 dp)

Question 10

a) to find the mid point you add the two x values together and divide by 2, and add the two y values together and divide by 2

$\left(\frac{5+11}{2}, \frac{13+1}{2}\right) = \left(\frac{16}{2}, \frac{14}{2}\right) = (8, 7)$

b) to uniquely define a line we need the gradient (m) and the y intercept (c) then we have $y = mx + c$ we have the intercept as we are told it passes through the point (0,7) so the intercept (c) is 7

the gradient will be the same as the gradient of AB as the line is parallel to AB

the gradient of AB is given by the difference in the y values divided by the difference in the x values

gradient AB = $\frac{13-1}{5-1} = \frac{12}{4} = 3$

so we have a y intercept of 7 and a gradient of 3

$y = 3x + 7$



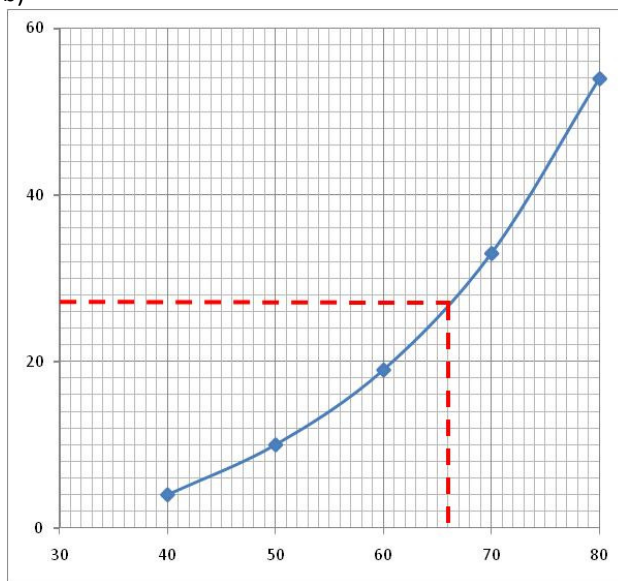
Question 11

a)

Life expectancy (t years)	Cumulative frequency
$30 < t \leq 40$	4
$30 < t \leq 50$	10
$30 < t \leq 60$	19
$30 < t \leq 70$	33
$30 < t \leq 80$	54

The total on the final line should be the total frequency (which it is ✓)

b)



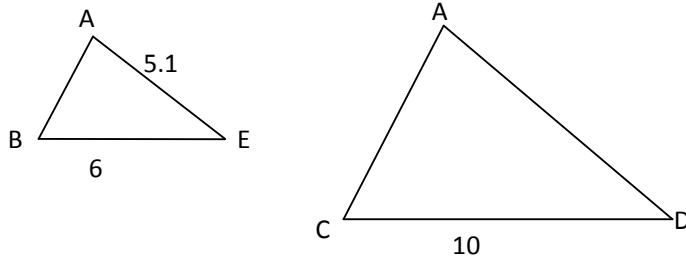
Note that when we plot the cumulative frequency graph we plot the end value with the cumulative frequency. For example for $30 < t \leq 50$ with cum frequency 10, we would plot (50,10)

c) to find the median we take half of the frequency (half of 54 is 27). We then look across to see where the horizontal line from 27 meets the curve. We then draw a vertical line down to see where this meets the x axis (shown on graph above with red dashed line)
median is 66



Question 12

a) with similar shapes I think it always helps to draw out the two shapes separately to make the comparisons easier:



To find length DE we must first find AD

We are going to the bigger triangle so we want $\frac{10}{6}$ as our scale factor (as opposed to $\frac{6}{10}$ if we were going to the smaller triangle)

$$AD = \frac{10}{6} \times 5.1 = 8.5 \text{ cm}$$

$$DE = 8.5 - 5.1 = 3.4 \text{ cm}$$

b) to get the scale factor for the areas we would have $(\frac{6}{10})^2$

we are trying to get $\frac{\text{area ABE}}{\text{area BCDE}} = \frac{\text{area ABE}}{\text{area ACD} - \text{area ABE}}$

we know that $\text{area ABE} = (\frac{6}{10})^2 \times \text{area ACD} = 0.36 \times \text{area ACD}$ so we have

$$\frac{\text{area ABE}}{\text{area ACD} - \text{area ABE}} = \frac{0.36 \times \text{area ACD}}{\text{area ACD} - (0.36 \times \text{area ACD})}$$

we can see that area ACD can be cancelled out as it is in every term in our fraction

$$\frac{0.36 \times \text{area ACD}}{\text{area ACD} - (0.36 \times \text{area ACD})} = \frac{0.36}{1 - 0.36} = \frac{0.36}{0.64} = \frac{9}{16}$$



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Question 13

a)

x	0.5	1	1.5	2	3	4	5
y	4.5 note 1	2	1.9 note 2	2.3	3.1 note 3	4.1 note 4	5.0

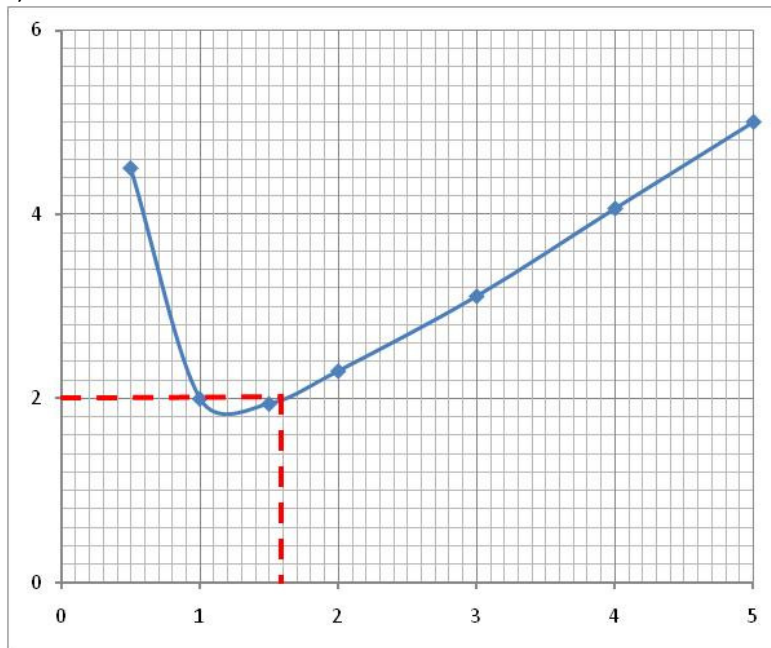
note 1: $0.5 + (1 \div 0.5^2) = 4.5$

note 2: $1.5 + (1 \div 1.5^2) = 1.9\dot{4} = 1.9$ (1 dp)

note 3: $3 + (1 \div 3^2) = 3.\dot{1} = 3.1$ (1 dp)

note 4: $4 + (1 \div 4^2) = 4.0625 = 4.1$ (1 dp)

b)



c)

i) substitute $x = 1$ into the equation:

$$1 + (1 \div 1^2) = 1 + 1 = 2$$

$$k = 2$$

ii) to find another solution we need to draw a horizontal line coming from $y = 2$ to meet our curve. Then drop this line down to meet the x axis. (shown as a red dashed line on the graph above)

this meets the x axis at 1.6 so 1.6 is another solution.

$$x = 1.6$$



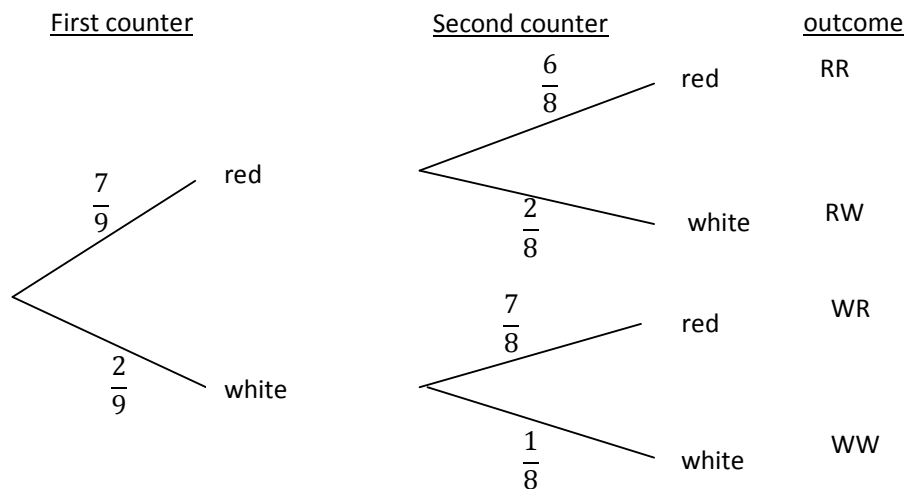
Question 14

a) the word "fully" implies that there is more than one thing that goes into both terms (3 and b)
 $3b(3a - 4b)$

b) $2ab^2 \times 2ab^2 \times 2ab^2 = 8a^3b^6$

Question 15

a) most probability questions can be made simpler by drawing a tree diagram



Note that the denominator changes with the second counter because the first counter has not been replaced so there are now only 8 counters to pick from

probability of red and red is

$$\frac{7}{9} \times \frac{6}{8} = \frac{7}{3} \times \frac{2}{8} = \frac{7}{3} \times \frac{1}{4} = \frac{7}{12}$$

b)

the two counters can be different colours by being red then white or white then red. We add these two probabilities

$$\left(\frac{7}{9} \times \frac{2}{8}\right) + \left(\frac{2}{9} \times \frac{7}{8}\right) = \frac{14}{72} + \frac{14}{72} = \frac{28}{72} = \frac{7}{18}$$



Question 16

a) by the "alternate segment theorem" angle ACD is 54° (alternate segment theorem states that the angle between a chord and tangent is equal to the angle in the alternate segment)

b) angle BCD is $36 + 54 = 90^\circ$, and since "angle in a semi-circle is a right angle", BCD is therefore a semi-circle and so BD is a diameter.

c) i) $180 - 78 = 102^\circ$

ii) opposite angles in a cyclic quadrilateral always add up to 180°

Question 17

a) let $R = 0.\dot{7} = 0.77777777...$

as there is one dot we multiply R by 10

$$10R = 7.77777777...$$

line up the decimal point and subtract R

$$10R = 7.7777...$$

$$-1R = 0.7777...$$

$$9R = 7$$

divide both sides by 9

$$R = \frac{7}{9}$$

b) i)

$$0.\dot{y} = \frac{y}{9} \text{ so } 0.0\dot{y} = \frac{y}{90}$$

ii)

$$0.1\dot{y} = 0.1 + 0.0\dot{y} = \frac{1}{10} + \frac{y}{90}$$

to add fractions we need a common denominator

$$\frac{1}{10} + \frac{y}{90} = \frac{9}{90} + \frac{y}{90} = \frac{9+y}{90}$$



Question 18

we can first factorise the denominator of the second fraction

$$x^2 + 5x + 6 = (x + 3)(x + 2)$$

we have

$$\frac{2}{x+2} + \frac{x}{(x+3)(x+2)}$$

In order to add fractions we need a common denominator
let the common denominator be $(x + 3)(x + 2)$

$$\frac{2(x+3)}{(x+3)(x+2)} + \frac{x}{(x+3)(x+2)}$$

expanding and adding the numerators

$$\frac{2x+6+x}{(x+3)(x+2)} = \frac{3x+6}{(x+3)(x+2)} = \frac{3(x+2)}{(x+3)(x+2)}$$

we can now cancel down the $(x + 2)$ to get

$$\frac{3}{(x+3)} = \frac{3}{x+3}$$

Question 19

If we work out the area of the whole **sector** OAB and then subtract the area of the **triangle** OAB we will have the area of the **segment**

$$\text{area of sector OAB} = \pi r^2 \times \frac{45}{360} = \pi \times 6.7^2 \times \frac{45}{360} = 17.62826 \text{ cm}^2$$

$$\begin{aligned} \text{area of triangle OAB} &= \frac{1}{2}ab\sin C \text{ (from formulae sheet) where } a = b = 6.7 \text{ and } C = 45^\circ \\ &= \frac{1}{2} \times 6.7 \times 6.7 \times \sin(45^\circ) = 15.87101 \end{aligned}$$

$$\text{area of segment} = 17.62826 - 15.87101 = 1.75725 = 1.76 \text{ (3 sf)}$$



Question 20

As AB is a tangent to the circle we know that angle ABC is a right angle.

Using Pythagoras' theorem we have that $a^2 + b^2 = c^2$ where $a = 3$, $b = r$, and $c = 2 + r$

$$3^2 + r^2 = (2 + r)^2$$

$$9 + r^2 = (2 + r)(2 + r)$$

expanding the RHS

$$9 + r^2 = 4 + 2r + 2r + r^2$$

grouping terms

$$9 + r^2 = 4 + 4r + r^2$$

subtract r^2 from both sides

$$9 = 4 + 4r$$

subtract 4 from both sides

$$5 = 4r$$

divide both sides by 4

$$1.25 = r$$

$$r = 1.25 \text{ cm}$$

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