

Paper 2 June 2018

1) Shaded area is a segment
(Think of a chocolate orange)

2) 6×10^7 is in standard form
this must be integer
this must be $1 \leq n < 10$

3) $y = 1\frac{1}{2}x$
so $y : x$
 $1\frac{1}{2} : 1$
 $3 : 2$

Just remember if x and y are expressed as an equation we swap the values around when expressing as a ratio
(No I don't really get it)
either - JUST DO IT

4) 40 as percentage 10.
Think about this. What is

2 as a % of 10

$$\frac{2}{10} \times 100 = 20\%$$

$$\frac{40}{10} \times 100 = 400\%$$

5) * arithmetic is 1 2 3 4 5 6
* geometric is 1 2 4 8 16 32
** fibonacci is 1 1 2 3 5 8

Triangular is 1 3 6 10 15 21

cube is 1 8 27 64 125 216

Square is 1 4 9 16 25 36

It is essential you recognise these and know how to create your own.
* are examples of
** is debatable.

6) $420000 \rightarrow 480000$
is $\frac{48}{42} = 1.14...$
or 14% increase

$$480000 \times 1.14... = 549000$$

so 549000 is wrong.
Liam increased by fixed amount and not a percentage.

7) $P(\text{hit}) = \frac{\text{total hits}}{\text{total throws}} = \frac{54}{90}$
 $= \frac{3}{5}$

Alternatively we could calculate the probability on each day and take the mean.

$$\text{Mean} \left(\frac{15}{20}, \frac{22}{30}, \frac{17}{40} \right) = \frac{229}{360}$$

7b) Wednesday seems a bad day.
Maybe he threw more because he kept missing.
So second method is probably more representative of his actual ability.

8)

	Theo	James
	£18	£0
wk1	£22-50	£4
wk2	27	8
wk3	31-50	12
wk4	36	16
wk5	40-50	20
wk6	45	24

Now I could have solved the equation

$$18 + 4.5n = 4n \times \frac{15}{8}$$

$$n \left(\frac{60}{8} - 4.5 \right) = 18$$

$$3n = 18$$

$$n = 6$$

but the direct method is probably quicker and safer.

9 a) 8.4 cm to 1 decimal place

$$8.35 \leq x < 8.45$$

because of the way rounding is taught (incorrectly) the examiner wants to see the symbol this way.

Just live with it for now. Penimeter error is

$$5 \times 8.35 \leq p \leq 5 \times 8.45$$

$$41.75 \leq p \leq 42.25$$

10. Volume Hemisphere 30cm.

$$= \frac{1}{4} \pi r^3$$

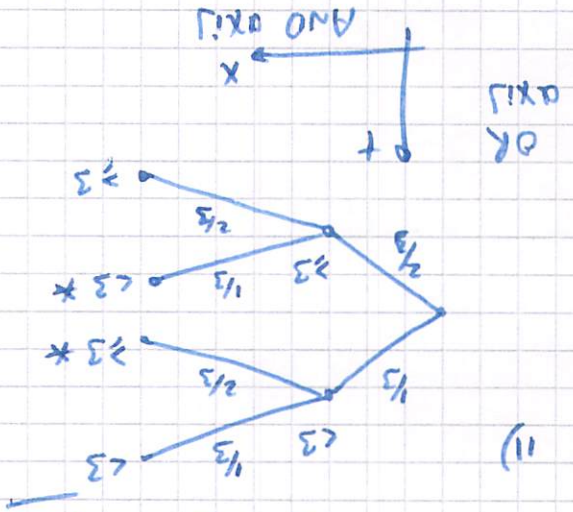
$$= \frac{1}{4} \times \frac{3}{4} \times \pi \times 30^3$$

$$= 18000\pi$$

$$\frac{18000\pi \text{ cm}^3}{4000 \text{ cm}^3/\text{min}} = 14.1 \text{ min.}$$

$$14.1 \text{ min} < \frac{1}{4} \text{ hour (15 min)}$$

so answer "yes"



verticals in each area of at least must add to 1.

$$P(\text{both dice} < 3) = \frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$$

$$P(\text{exactly one die} < 3) = \frac{1}{3} \times \frac{2}{3} + \frac{2}{3} \times \frac{1}{3} = \frac{4}{9}$$

$$= \frac{2}{3} \times \frac{2}{3} = \frac{4}{9}$$

12) If 1cm = 1 unit

and remembering you're probably working off a paper that's been reduced by 70%

$$\text{gradient} = \frac{\Delta y}{\Delta x} = \frac{8}{4} = 2$$

Even if the scale is incorrect, interpret the gradient is the same as it's affecting both axes.

13)

$$\frac{8x^2 - 8}{4x + 4} = \frac{8(x^2 - 1)}{4(x + 1)}$$

$$= \frac{4(x - 1)(x + 1)}{4(x + 1)}$$

$$= 2(x - 1) = 2x - 2$$

Note that is a technical issue that we can't divide by zero so when cancelling (x+1) we have to exclude the possibility x = -1.

$$\text{so } \frac{x^2 - 1}{x + 1} \text{ is not strictly the same as } x - 1.$$

break in the first expression we have to exclude x = -1 when we now, the examiner does the thinking for you.

14)

This is a construction. Ask for separate worksheet. Ratio drawing circle with a pair of compasses.

15) Because

$$10 \text{ men} < 10 \text{ women}$$

Men are more consistent than women.

well in this particular test.

(but leave it at that)

16) Density = mass/volume

The clue is in the units.

$$\text{so } 2400 = \frac{\text{mass}}{3.8 \text{ m}^3} \text{ kg/m}^3$$

$$\text{mass} = 2400 \text{ kg/m}^3 \times 3.8 \text{ m}^3$$

Note that not only do we "do" the calculation we can also check that all the units balance.

$$\text{mass} = 9120 \text{ kg.}$$

17) Volume cylinder

$$\pi r^2 h \text{ and}$$

$$\pi \times 0.5^2 h = 3.8$$

$$h = \frac{3.8}{\pi \times 0.5^2} = 4.84 \text{ metre}$$

17) Read off graph
3 seconds

b) The ball is at instantaneous rest at the maximum value which occurs at $1\frac{1}{2}$ sec.

c) Average speed of ball thereafter.

$$= \frac{\Delta h}{\Delta t} = \frac{4.6}{3.5 - 1.5} = 2.3 \text{ m/sec.}$$

$$18) 3^x = 300$$

$$x = 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8$$

$$3^x \quad 3 \quad 9 \quad 27 \quad 81 \quad 243 \quad 729$$

↑↑
here

so x between 5 and 6

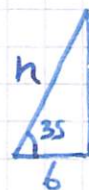
There isn't really another way on our present mathematical knowledge.

$$\text{At 'A' level } x = \frac{\log 300}{\log 3} \approx 5.2$$

so 5 and 6
as above.

Try this on your calculator.

19)



$$\cos 35^\circ = \frac{6}{h}$$

$$h = \frac{6}{\cos 35^\circ}$$

$$125 - 90 = 35^\circ \quad 6 \text{ is } \frac{1}{2} 12.$$

$$\text{so perimeter} = 3 \times 12 + \frac{2 \times 6}{\cos 35^\circ} = 50.6 \text{ to 3 s.f.}$$

$$20) \text{ Volume ring} = \frac{1}{4} \pi^2 (b-a)^2 (b+a)$$

This is not a very well known formula. I would have had to look it up.

Enter all the figures carefully

We should get 12337.00...

$$\Rightarrow 12300 \text{ cm}^3 \text{ (3 s.f.)}$$

21) We need to work out distance
Tia to Shop

Use cosine formula

$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$c^2 = 60^2 + 80^2 - 2 \cdot 60 \cdot 80 \cdot \cos 75^\circ$$

Enter all this carefully and

$$c = 86.7 \text{ m.}$$

so Liz will arrive first.

If Liz walks faster she will arrive even sooner than Tia.

22) if the radius of a circle is 5
at is centred at (0,0)
the equation will be

$$x^2 + y^2 = 25 \quad (r^2)$$

23)

$$x : y$$

$$\text{volume } 64 : 343 \quad \text{cubed}$$

$$\text{area } 16 : 49$$

$$\text{if } 176 : \frac{49}{16} \times 176 = 539 \text{ cm}^2$$

24) Tank capacity

$$\text{Minimum } 49.5 \times 34.5 \times 19.5 \\ = 33301$$

$$\text{Maximum } 50.5 \times 35.5 \times 20.5 \\ = 36751$$

$$33301 < 34000 < 36751$$

therefore it is not possible to say which has greater capacity

25)



$$P(\text{chemistry} | \text{physics}) \\ = \frac{x}{35+x} = \frac{5}{12}$$

$$12x = 35 \times 5 + 5x$$

$$7x = 35 \times 5$$

$$x = 35 \times 5 / 7 = 25$$

$$\text{so } y = 150 - 47 - 25 - 35 \\ = 43$$

$$P(\text{doesn't study chem. or physics}) \\ = \frac{43}{150}$$

$$P(C' \cup P') = \frac{43}{150}$$

26) $y = 4x^2 + 5x + 3$

$$y = x + 2$$

intersection is

$$4x^2 + 5x + 3 = x + 2$$

$$4x^2 + 4x + 1 = 0$$

for one point intersection

$$b^2 = 4ac$$

$$16 = 4 \times 4 \times 1$$

which is true

In fact $4x^2 + 4x + 1 = (2x+1)^2$
another indication.

27) let $\ell = 2.7555 \dots$

$$10\ell = 27.555 \dots$$

$$- \ell = 2.755 \dots$$

$$9\ell = 24.8$$

$$\ell = \frac{24.8}{9} \times \frac{5}{5} = \frac{124}{45}$$

28) $f(x) = 5 - x$ $g(x) = 3x + 7$

$$f(2x) = 5 - 2x$$

$$g(x-1) = 3(x-1) + 7$$

$$\text{so } 5 - 2x + 3x - 3 + 7 \\ = x + 9$$

b) $g(x) = 3x + 7$

$$y = 3x + 7$$

$$y - 7 = 3x$$

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

$$f^{-1}(x) = x - 7/3$$

$$\text{so } \frac{x-7}{3} = 2x$$

$$x - 7 = 6x$$

$$5x = -7$$

$$x = -7/5$$

ROBERT GOODHAND