Paper 2 Nov. 17

1) $3.875 = \frac{31}{8}$

We can actually do this on our calculator.
$S \Leftrightarrow D$ function.

2) 50 as a percentage 20

$50 \div 20 \times 100 = 250\%$

Examiners always asking percentages "this way round"

3) $y = x^3$

We can do this on our calculator.

Note $1 \div 3 = Ans$
$Ans^3 = Ans$
$Ans \; S \Leftrightarrow D = \frac{1}{27}$

So Not on line is $(\frac{1}{3}, \frac{1}{9})$

4) Density is mass/volume.
kg m^3
See Physics formula worksheet.

5) $4(3x-2) = 2x-5$

$12x - 8 = 2x - 5$
$10x = 3$
$x = \frac{3}{10}$

6. Coord (6, 4) is on the line

area x length = volume
$6 \times 4 = 24$

b) $\frac{1}{2} \times 6 \times h \times 5 = 24$

$h = \frac{24 \times 2}{6 \times 5}$

$= \frac{8}{5} = 1\frac{3}{5}$

7) This is an enlargement
scale factor $\frac{1}{3}$
centre (5, 1)

see drawing.

8)

distance	freq.	mid	Product
$0 < x \leq 5$	20	$2\frac{1}{2}$	50
$5 < x \leq 10$	48	$7\frac{1}{2}$	360
$10 < x \leq 15$	30	$12\frac{1}{2}$	375
$15 < x \leq 20$	22	$17\frac{1}{2}$	385
	120		1170

estimate mean = $\frac{1170}{120} = 9.75$

Even though the examiners give you a table this can be completed on the calculator in one hit. using the = and Ans buttons Ask your tutor to show you how.

9) $\tan^{-1} x = 3/7 = 23.2$

2 marks for this. Easy!

10) 5 8 14 23 35
3 6 9 12
3 3 3

The 5th term is 35.

Again a really easy question.

Note for any question that asks what is the next term, this technique with a few caveats is always the best start.

11) $$\frac{3x^2}{6x^2+3} = \frac{3x^2}{3(2x^2+1)}$$

$$= \frac{x^2}{2x^2+1}$$

which is an option given.

12) Population Density$_{UK}$ $= \frac{64000}{95}$

$= 674$

No point entering unnecessary Qs
Just cancel in your head.
No decimals in answer

Pop Density$_{Germany}$ $= \frac{82000}{140}$

$= 586$

The population densities are of the same order. Similar.
UK is just 15% more

13) $y = 3x$

$(-3, -1)$ ✗
$(-1, -\frac{1}{3})$ ✗
$(-1, -3)$ ✓
$(-\frac{1}{3}, -1)$ ✓ } possible

coordinates of are $(-\frac{1}{3}, -1)$
as it is also on $y = -1$

14) $h_2 = \frac{3}{4} \times \frac{3}{4} \times 15$

$= 8.4375$

but $h_2 = \frac{3}{4} \times \frac{2}{3} \times 15$

$= 7.5$

so the ball bounced lower than expected.

This makes sense in Physics. If the ball always bounced 3/4 previous bounce it would theoretically bounce infinite number of times when obviously it eventually stops.

15) $6000 \times 1.015^x > 7000$

This is a trial and error at GCSE. Try 10

$6000 \times 1.015^{10} = 6973$

Try 11: $6000 \times 1.015^{11} = 7067$

So 11 years required.

At 'A' level we would solve

$$x = \frac{\log(7/6)}{\log 1.015}$$

$= 10.35 \Rightarrow 11.$

So now you know what those log buttons are for.

16) Factorise $9y^3 - 6y$

By inspection factor is $3y$

$9y^3 - 6y = 3y(3y^2 - 2)$

b) $3x^2 - 22x + 7$

This is one for Lizzie's method.

$\Rightarrow x^2 - 22x + 21$

$= (x-21)(x-1)$

$\Rightarrow (x - \frac{21}{3})(x - \frac{1}{3})$

$\Rightarrow (x-7)(3x-1)$

checking back we get

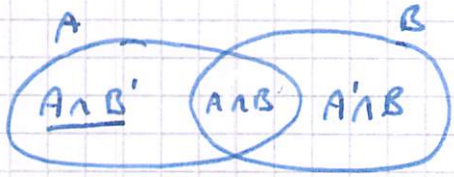
$3x^2 - 21x - x + 7$

$= 3x^2 - 22x + 7$ ✓ checks

Whenever we use Lizzie's method always check back because occasionally we might need to make a minor adjustment. But not today"

17. Area parallelogram
$= 2 \times$ area triangle
$= 2 \times \frac{1}{2} 12 \times 16 \times \sin 72°$
$= 182.6$ (1 dec. place) cm^2

18)



$A' \cap B'$

These are the 4 areas of the Venn diagram expressed as intersects. LEARN THEM.

It is also possible to express these 4 areas as UNIONS

$A \cap B' \equiv (A' \cup B)'$
$A' \cap B' \equiv (A \cup B)'$
$A' \cap B \equiv (A \cup B')'$
$A \cap B \equiv (A' \cup B')'$

Can you spot the patterns. Your tutor can show you how to switch backwards and forwards

b) Now the shaded region is the complement of $A \cup B$ so $(A \cup B)'$

which $\equiv A' \cap B'$

The examiner is looking for $(A \cup B)'$ because that's the given option.

19) $5w \times w = 1620$
$5w^2 = 1620$
$w = \sqrt{\frac{1620}{5}} = 18$ ✓

Careful. The question asks for width, not length.
so yes 18 is the answer.

20) This is a standard question that always crops up in one of the three papers. LEARN THE METHOD
$h \propto v^2$ replace $\propto$ with $= k$
$h = kv^2$
We are then given example values of h and v to allow us to calculate k.

$5 = k 10^2$
$k = 5/100 = 0.05$

So we now get $h = 0.05 v^2$
and now we substitute a value for v to find h.
$h_{max} = 0.05 \times 24^2$
$= 28.8$ metres. ✓

Now that has to be an easy 4 marks.

21) if Meera draws a line at $y = 3x$ we'd then have the intersect $2x^2 = 3x$
so $2x^2 - 3x = 0$

The two functions intersect at
$x = 0$ and $x = 1.5$ ✓
which are the two solutions

b) Levi's method is OK EXCEPT when he divides by x.
At this point he misses solution $x = 0$.
It's a common mistake. Apparently Stephen Hawking made this mistake and a student pointed this out to him at a public seminar which some said was a bit embarrassing.
But would you pass up the chance to show when Stephen Hawking was wrong. ✓

22) Total area $= \frac{1}{2}\pi 25^2$

$= 312.5\pi$

Area sector $= \frac{150}{360} \times \pi 12^2$

$= 60\pi$

NOT REQUIRED: Area shaded $= (312.5 - 60)\pi$

$= 252.5\pi$

$\frac{\text{Area white}}{\text{Area whole}} = \frac{60\pi}{312.5\pi}$

$\Rightarrow 19.2\%$

So the answer is NO. That we got a % so close to 20% is a strong indicator we've performed the correct calculation.

23) Histogram

First block

$20 \times$ frequency density $= 30$

so frequency density at this point $= 1.5$

So now we can label the frequency density

Now we plot the last bar.

$15 \times$ freq. density $= 12$

so freq. dens. $= 0.8$

and we draw in at height 0.8

b) total membership is

20×1.5	$= 30$
10×4.5	$= 45$
10×3.6	$= 36$
25×2.0	$= 50$
15×0.8	$= 12$
	173

ROBERT GOODHAND

24) Let Beth's time $= t$

Area trapezium $= \frac{1}{2}(t + t - 8)9$

$= (t-4)9$

and $9t - 36 = 200$

$t = \frac{236}{9}$

$= 26.2$

So Beth just beat Amy.

25) For upper bound pressure we take the lower bound area

Pressure = force/area

$= \frac{347.5}{2.55 \times 6.35}$ ← upper bound force.

$= 21.46\ N/m^2$

26) $\overrightarrow{BE} = a + 2b$

$\overrightarrow{CD} = -b + 2a - a + 3b$

$= a + 2b$

so $BE \parallel CD$

$\overrightarrow{BC} = a + 2b + b - 2a$

$= -a + 3b$

$\overrightarrow{ED} = a - 3b$

so $BC \parallel ED$

Therefore BECD parallelogram.

27) $\frac{x}{4} - \frac{2x}{x+2} = 1$

$x(x+2) - 4(2x) = 4(x+2)$

$x^2 + 2x - 8x = 4x + 8$

$x^2 - 10x - 8 = 0$

$(x-5)^2 - 25 - 8 = 0$

$(x-5)^2 = 33$

$x = 5 \pm \sqrt{33}$

$= 10.74$ or -0.744

I could have used the quadratic formula but when $a = 1$ this is actually a simpler and more direct method.