Paper 1 Nov. 19

1) $250 - 15\% = 250 \times 0.85$ ✓

2) if $3x = 2x$ then $x = 0$

what we cannot do is say

$3x = 2x$

then divide through by x

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

so $3 = 2$

This is obviously wrong and we've also missed the solution that $x = 0$. ✓

3) Midpoint $(2, 13)$ and $(10, 1)$

is $\left(\frac{2+10}{2}, \frac{13+1}{2}\right)$

$= (6, 7)$ which is one of the given options. ✓

4) $(2x)^4 = 2x \times 2x \times 2x \times 2x$

$= 2^4 x^4$

$= 16x^4$ ✓

which is one of the given options

5) The line of reflection is

$y = -1$ ✓

Remember in the coordinate system xy the x is horizontal and the y is vertical

BUT

$x = 2$ or $x = 3$ or $x = -5$

are VERTICAL lines

and

$y = 2$ or $y = 3$ or $y = -5$

are HORIZONTAL lines

6) The statement is incomplete

It is a rotation about centre $(0, 0)$ ✓

Reflections are about a line

Rotations are about a point plus the degree of rotation.

6a) $4 \times r = 16$

$r = \frac{16}{4} = 4$

so the next term is 16×4

$= 64$ ✓

Geometric progressions change by multiplying by a specific number.

b) Fibonacci sequences at the previous 2 terms.

so $3 + -8 = -5$ ✓

$-8 + -5 = -13$ ✓

7. $a \times 60 = b$

so $4b = 4a \times 60$

so $\frac{4b}{a} = 240$ ✓

8. $27 \times (3^2)^7 = 3^3 \times 3^{14}$

$= 3^{17}$ ✓

9. Vol. cylinder $= \pi r^2 l$

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

Vol cylinder $= \pi 4^2 10$

$= 160\pi$ ✓

Vol hemisphere $= \frac{2}{3} \pi 6^3$

$= 144\pi$ ✓

so the cylinder has greater volume.

(This is a non calculator paper so we need to have a firm grounding in numeracy)

10)

	Red	White	
Rose Pink	1	2	3
$\times 20$	20	40	60 $\times 20$
Now we add	+80	+28	
to get	100	68	✓
which reduces to	25	17	

Cherry Pink is $\times 6$ (4 : 3 / 24 : 18) $\times 6$

so +1 on the white −1 on the red needed.

Not quite Cherry Pink! ✓

11a) $\frac{2 \times 10^{14}}{8 \times 10^{9}}$

$= \frac{1}{4} \times 10^{5}$

$= 0.25 \times 10^{5}$

$= 2.5 \times 10^{4}$ ✓

11b) $6200.07 = 6.2 \times 10^{c} + 7 \times 10^{d}$

by inspection $c = 3$ ✓
$d = -2$

if you don't understand this ask your tutor for further explanation.

12) $V = \frac{K}{H}$

Replace $=k$ by $\propto$

$V \propto \frac{1}{H}$

SO V IS INVERSELY PROPORTIONAL to H
DIRECTLY PROPORTIONAL TO $\frac{1}{H}$ ✓

13) n^{th} term sequence $\frac{n(n-4)}{\sqrt{n+3}}$

so 1st. term $= \frac{1(1-4)}{\sqrt{1+3}}$

$= -3/2$

6^{th} term $= \frac{6(6-4)}{\sqrt{6+3}}$

$= \frac{12}{3} = 4$

so $1^{st} + 6^{th} = 4 - 3/2$

$= 2\frac{1}{2}$ ✓

There is nothing difficult about this. You just need to be confident in numeracy and follow through carefully. It's an easy 3 marks.

14) $8300 = 100 \times 83$

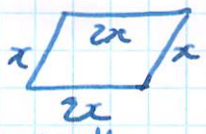
$\sqrt{8300} = \sqrt{100 \times 83}$

$= \sqrt{100} \times \sqrt{83}$

$= 10 \times 9$ plus a bit

closest value $= 90$ ✓

15.



So nominally a rectangle but it could have been stepped on which would turn it into a parallelogram.
Technically rectangles are parallelograms but parallelograms may not be rectangles.

so rectangle	may be true ✓
parallelogram	is true ✓
rhombus	not true ✓
kite	not true ✓

Ask for the explanation sheet that covers all quadrilaterals.

16) Classify as

	Large	Small	Total
Yellow	18	12	30
Green	27	63	90
Total	45	75	120

$45 \times \frac{5}{3} = 75$

green is 300% yellow so divide the total by 4

12 small yellow allows us to fill in all the blanks

The secret here is a clear chart. They've even given you one!

Large green = 27 ✓

17) $a = \begin{bmatrix} -3 \\ 2 \end{bmatrix}$ $b = \begin{bmatrix} 1 \\ -5 \end{bmatrix}$

$a - 3b = \begin{bmatrix} -3 \\ 2 \end{bmatrix} - 3\begin{bmatrix} 1 \\ -5 \end{bmatrix}$

$= \begin{bmatrix} -3 \\ 2 \end{bmatrix} - \begin{bmatrix} 3 \\ -15 \end{bmatrix} = \begin{bmatrix} -6 \\ 17 \end{bmatrix}$ ✓

which is one of the given options.

18) $\frac{x+15}{3} = 2(x+10)$

$x + 15 = 6(x+10)$

$x + 15 = 6x + 60$

$5x = -45$

$x = -9$ ✓

check back LHS $= \frac{-9+15}{3} = 2$

RHS $= 2(-9+10) = 2$ ✓

19) Two box plots A and B.

On average which team ran further?
Many students will answer B because of the key values of B are greater than A.
That is Lowest
Lower Quartile
Upper Quartile
Highest.
but for "average" the one we examine is the median.

Team A Median = 9.8 ✓
Team B Median = 9.7 ✓

b) Team A IQR = 9.9 - 9.5
= 0.4 ✓
Team B IQR = 10.1 - 9.6
= 0.5 ✓
So Team A are the more consistent.

20)

House chosen at random it has a garage. shed?

We write P(shed/garage)
which reads what is the probability a house has a shed given that it has a garage.
The garage population is 21
Of those 8 have a shed.
So P(shed/garage) = $\frac{8}{21}$ ✓

b) Using the same method
P(shed / garage) = $\frac{4}{15}$ ✓

because houses without garages
= 11 + 4
and 4 of those don't have sheds.

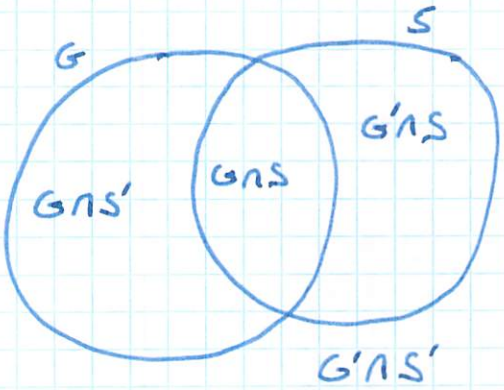
c) Show that $P(G \cap S)' > P(G \cup S')$

$(G \cap S)'$ means everything not $G \cap S$
$G \cap S$ is the intersection of G S.
So $(G \cap S)' = 36 - 8 = 28$
$P(G \cap S)' = \frac{28}{36}$ ✓
and there is no need to simplify.

$G \cup S'$ is everything - the union - of garages and not sheds.
garages = 13 + 8
plus the 4 that have neither.
So $G \cup S' = 25$
$P(G \cup S') = \frac{25}{36}$ ✓

So we have proved
$P(G \cap S)' > P(G \cup S')$ ✓

We might as well take the trouble to label all the areas of a Venn diagram.



Ask your tutor to explain the following relationships

$(G \cap S')'' = (G' \cup S)'$
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$(G' \cap S)'' = (G \cup S')'$
$(G' \cap S')'' = (G \cup S)'$

21) $0.70484848 - 0.001$

0.70384848

$= 0.703\dot{8}\dot{4}$ ✓

which is a given option.

22) For line m

gradient: $\frac{10-0}{0-4} = -5$

So gradient L is also -5.

For L we use the equation.

$y - y_1 = m(x - x_1)$

(x_1, y_1) is $(-3, 10)$ so.

$y - 10 = -5(x - -3)$

$y - 10 = -5(x + 3)$

$y - 10 = -5x - 15$

$y = -5x + 25$ ✓

23) $5x^2 + 6x - 8$ factorise

use Lizzie's method.

Step 1. Eliminate "a" and add "ac"

$x^2 + 6x - 40$

Step 2 factorise $(x + 10)(x - 4)$

Step 3 Add back the "5"

$(x + \frac{10}{5})(x - \frac{4}{5})$

Step 4 simplify and/or rationalise

$\Rightarrow (x + 2)(5x - 4)$ ✓

which incredibly is correct.

"Lizzie" is Elizabeth Seagle and her Maths Teacher at West Bloomfield High School in America. It's actually a reformulation of Vieta's method. Not a lot of Maths teachers seem to know this.

24) $\frac{\sqrt{18} - 28}{\sqrt{50}}$

$\sqrt{18} = \sqrt{9 \times 2} = 3\sqrt{2}$

$\sqrt{50} = \sqrt{25 \times 2} = 5\sqrt{2}$

so $\frac{\sqrt{18} - 28}{\sqrt{50}} = \frac{3\sqrt{2} - 28}{5\sqrt{2}}$

At this point we might spot that if we rationalise the denominator of the second expression we will get two expressions in $\sqrt{2}$ which will simplify as required.

$\Rightarrow 3\sqrt{2} - \frac{28}{5\sqrt{2}} \frac{\sqrt{2}}{\sqrt{2}}$

$= 3\sqrt{2} - \frac{28}{10}\sqrt{2}$

$= 3\sqrt{2} - 2.8\sqrt{2}$

$= 0.2\sqrt{2} = \frac{\sqrt{2}}{5}$ ✓

25) bag contains 8 balls

3 red and 5 blue

2 balls removed.

P(at least one red still in bag) = 1

because there are 3 red to start with and only 2 removed. ✓

P(at least 2 reds still in bag)

= P(1st blue 2nd blue) + P(1st blue 2nd red) + P(1st red 2nd blue) } P(1st blue)

$= \frac{5}{8} + \frac{3}{8} \times \frac{5}{7}$

$= \frac{35}{56} + \frac{15}{56} = \frac{50}{56} = \frac{25}{28}$ ✓

I think this is the neatest way. There are other ways but will all reduce to the same probability.

26) Circumference circle ① = perimeter sector ②.

① $= 2\pi r$

② $= \frac{x}{360} 2\pi r + 2r$

① = ②

$\frac{x}{360} 2\pi r + 2r = 2\pi r$

$\frac{x}{360} 2\pi r = 2\pi r - 2r$

$x = \frac{360(2\pi r - 2r)}{2\pi r}$

Now we cancel out all the r's.

$x = \frac{360(2\pi - 2)}{2\pi}$

and we cancel out all the 2's

$x = \frac{360(\pi - 1)}{\pi}$

X { Enter $\pi - 1 =$ / Ans $\times 360 \div \pi =$ } sorry this is non-calculator X

27) $y = x^2 - 6x + 17$

$= (x-3)^2 - 9 + 17$

$= (x-3)^2 + 8$

so turning point is $(3, 8)$ ✓

b) $y = x^2 + 4x + b$

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

and $-4 + b = 8$

so $b = 12$ ✓

if your tutor has been kind enough to lend you a graphical calculator then experiment with these two quadratics and verify the answers are correct.

28) $100^{-\frac{1}{2}} = \frac{1}{100^{1/2}}$

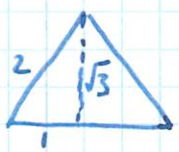
$= \frac{1}{\sqrt{100}}$

$= \frac{1}{10}$ ✓

that has to be an easy 2 marks.

29) $5 \sin 30^\circ \times \cos 30^\circ \times 8 \tan 30^\circ = ?$

this is a non-calculator paper so we need to work all these out from first principles.



draw equilateral Δ

height is $\sqrt{3}$

so $\sin 60 = \sqrt{3}/2$

$\cos 60 = 1/2$

$\sin 30 = 1/2$

$\cos 30 = \sqrt{3}/2$

$\tan 60 = \sqrt{3}$

$\tan 30 = 1/\sqrt{3}$

so expression $= 5 \times \frac{1}{2} \times \sqrt{3}/2 \times 8 \times 1/\sqrt{3}$

and those $\sqrt{3}$s conveniently cancel.

$= 5 \times 8 / 2 \times 2$

$= 10$ ✓

and if you actually do try punching all that into your calculator the answer is indeed 10.

ROBERT GOODHAND