Paper 2 June 2020

1) $x + 4x \equiv 5x$

≡ means an identity. It is true whatever the value of x. Often we don't bother to write correctly and just use an = sign.

2) The congruence is SAS. Learn all the different congruencies.

3) 5.2×10^{-4} is standard form.
This number $1 \leq n < 10$
integer

4) when $a < -1$
largest value is a^2.

5) complete the graph
read off value.
Check with your tutor.

This is a very poor question.
In statistics you are taught never to extrapolate.

Hint If you come across this again play the examiner's game but write on the bottom "However we were taught never to extrapolate"

6) HCF (75, 105)

The "safe" way is to list the factors

1×75	1×105
3×25	3×35
5×15	5×21
	7×15

HCF

Remember given two numbers the HCF is equal or lower and the LCM is equal or higher.
Also HCF × LCM = product
not a lot of people know this.

The mathematical way is

$75 = 3 \times 5^2$
$105 = 3 \times 5 \times 7$

choose the lower indices.

HCF(75, 105) = 3×5

If we wanted the LCM it is

$$\frac{75 \times 105}{15} = 525$$

But again the safe way is to write out the multiples

75	105
150	210
225	315
300	420
375	525
450	
525	

Here is the L.C.M.

7a) $x^2 - 7x + 10 = 0$
factorise to give

$(x-2)(x-5) = 0$
Either $x - 2 = 0$
or $x - 5 = 0$
So roots are $x = 2$ or $x = 5$

b) To find the turning point we "complete the square"

$x^2 - 7x + 10 = (x - 3\frac{1}{2})^2 - 12\frac{1}{4} + 10$
$= (x - 3\frac{1}{2})^2 - 2\frac{1}{4}$

so the turning point is
$(3\frac{1}{2}, 2\frac{1}{4})$

To summarise.

In the form $x^2 - 7x + 10 = 0$
gives us the y-intercept 10.

In the form $(x-2)(x-5) = 0$
gives us the roots 2 or 5
i.e. the x intercepts.

In the form $(x - 3\frac{1}{2})^2 - 2\frac{1}{4}$
gives us the turning point
$(3\frac{1}{2}, 2\frac{1}{4})$

8)

Women	:	Men	Total
48	:	42	90
$-x$		$+y$	

ratio now 10 : 11

so let's assume we now have

40	:	44	84

No. There are not more than 90 people at the party.

The secret here is a clear layout.

9) Cuboid $y \times 5 \times 5$

Total surface area is

$2(5\times5 + 5\times y + 5\times y)$

ends sides top bottom

$\Rightarrow 2(25+10y) = 200$

$10y = 25$

$y = 7\frac{1}{2}$

So volume $= 5\times5\times7\frac{1}{2}$

$= 187\frac{1}{2}\ cm^3$

b) If the surface area < 200

then $y < 7\frac{1}{2}$

so volume is less

10) Alex and Bev sit 6 tests so marks each

Total marks $2\times6\times50 = 600$

(does this mean they sat 6 tests in total or 6 tests each?)

	Alex	Bev	Total.
Potential	300	300	600
Potential Scats	250	250	500
%	60%	52%	
Actual marks	150	130	
6th test	24		
	174	174	174−130

Bev scored 44/50

So with a clear layout this is quite easy.

11) silver mass = 2.625 kg.

volume = 250 cm^3

density = mass/volume

$= 2.625/250$

$= 0.0105$

$0.0105\ \frac{kg}{cm^3} \times \frac{1000\ grams}{1\ kg}$

$= 10\frac{1}{2}\ grams/cm^3$

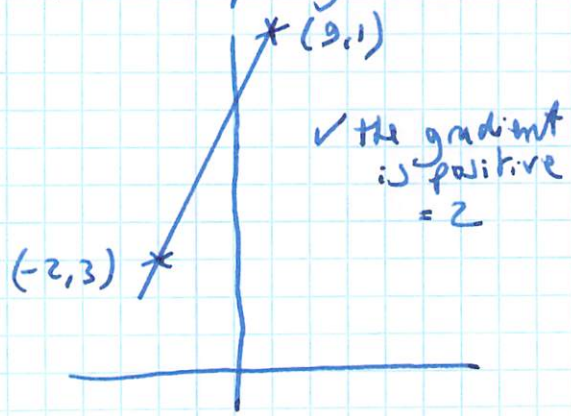
12) straight line (−2, 3) to (1, 9)

gradient $= \frac{\Delta y}{\Delta x} = \frac{9-3}{1--2}$

$= \frac{6}{3}$

$= 2$

You could quickly sketch this



13) Area parallelogram is

$\frac{1}{2}(a+b)\times l$

$\frac{1}{2}(2.8+2.1)\times l = 39.2$

$l = \frac{39.2\times2}{4.9}$

$l = 16$

This is a really easy 3 marks.

14) Prediction of runners is

6500×1.05^3

$= 7524$

so the prediction is there will be more than 7500 runners.

15) $a = \frac{b}{c} + 5$

rearrange to make c subject

$\frac{b}{c} = a - 5$

$c = \frac{b}{(a-5)}$

16)

gluten free $22 \times \frac{4}{11} = 8$

rice dishes $= 7$

naan bread $5 \times 0.4 = 2$

Gluten free meal deals

$= 8 \times 7 \times 2 = 112$ choices

17) Cumulative frequency curve

Just read off mark at 100

$= 83$ grams.

Easy!

b) Read off at 90 grams 158

Estimated cost $= 158 \times 32 + 42 \times 39$

$= £66.94$

18) let height be h.

$\tan 62° = \frac{h}{5}$

$h = 5 \tan 62°$

in second triangle

$\sin x = \frac{5 \tan 62}{12}$

$x = \sin^{-1} \frac{5 \tan 62}{12}$

Using your calculator

Enter $5 \tan 62 =$

Ans $\div 12 =$

$\sin^{-1}$ Ans $=$

$51.6°$

By using the Ans button we don't need to write down interim results.

By using = after $5 \tan 62$ we avoid the need by the closing bracket and ÷.

19) $\frac{7a + 2b - 3a}{8a + 6b + 2a - b}$

$= \frac{4a + 2b}{10a + 5b} \times \frac{5}{2} \times \frac{2}{5}$

$= \frac{20a + 10b}{20a + 10b} \times \frac{2}{5}$

$= 0.4$

20) interior angle decagon $=$

$180 - 36 = 144$

We can divide given shape into 3 triangles

Total internal angles $= 3 \times 180$

so $144 \times 3 + 2w = 3 \times 180$

so $w = \frac{3(180 - 144)}{2}$

$= 54°$

21) $y = \frac{1}{x}$

check $\frac{1}{2.5} = 0.4$

so point is $(2.5, 0.4)$

b) $y = 2^x$

when $x = 4$ $y = 2^4$

$= 16$

but Leo has plotted at 15

22) $y = 1 + \sin x$

is $\sin x$ moved up 1 unit

so Graph A.

23) $AC^2 = 5^2 + 12^2$

$AC = 13$

(right angled triangle 5, 12, 13)

$CM^2 = 16^2 - 13^2$

$CM = \sqrt{87}$

so $CF = 2\sqrt{87}$

Volume prism $= \frac{1}{2} \cdot 5 \cdot 12 \cdot 2\sqrt{87}$

$= 60\sqrt{87}$

$= 560 \text{ cm}^3$ (3 sig fig)

24) Ask invigilator for tracing paper.

You should determine coord. C at $(-5, -6)$

b) If P and R are invariant when reflected the line of reflection must be $y = -x$

25) $3x^2 + 11x - 20$

This is a classic for Lizzie's method

Step1 Eliminate the 3 and change 20 to 20×3

$\Rightarrow x^2 + 11x - 60$

Step2 Factorise

$(x - 4)(x + 15)$

Step3 Divide both second terms by 3.

$(x - \frac{4}{3})(x + \frac{15}{3})$

Step4 Simplify and/or multiply through as necessary

$(3x - 4)(x + 5)$

Step5 check correct

$3x^2 - 4x + 15x - 20$

$\Rightarrow 3x^2 + 11x - 20$

Ask your tutor to run through a few more examples of Lizzie's method.

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26) Max load calculation.

Potatoes max. 25½ kg

carrots max. 7.5 kg

Load = $30 \times 25.5 + 20 \times 7.5$

$= 916$ kg. < 920 kg

So she can carry the load safely.

27) Draw 2 discs

Prob (1st disc < 2nd disc)

Possibilities are

draw 11 then	22 or	33 or 44
draw 22 then		33 or 44
draw 33 then		44

$= \frac{4}{20} \times \frac{6}{19} + \frac{4}{20} \times \frac{7}{19} + \frac{4}{20} \times \frac{3}{19}$

$+ \frac{6}{20} \times \frac{7}{19} + \frac{6}{20} \times \frac{3}{19}$

$+ \frac{7}{20} \times \frac{3}{19}$

$= \frac{4\times6 + 4\times7 + 4\times3 + 6\times7 + 6\times3 + 7\times3}{20\times19}$

$= \frac{145}{20\times19} = \frac{29}{76}$

Just remember AND means × OR means +

Sometimes it is easy to calculate the complement of what is asked and subtract the answer from 1 but this isn't one of them! It seems you have to plough through the whole calculation.

But having said that I've just spotted a quicker way. I don't have to split up the discs into separate groups.

Probability is

draw 11 then (22 or 33 or 44)

draw 22 then (33 or 44)

draw 33 then (44)

So it is $\frac{4}{20} \times \frac{16}{19} + \frac{6}{20} \times \frac{10}{19}$

$+ \frac{7}{20} \times \frac{3}{19}$

$= \frac{4\times16 + 6\times10 + 7\times3}{20\times19}$

$= \frac{145}{20\times19} = \frac{29}{76}$ as before

28) Multiply the units of the axis together.

y is metres/second

x is seconds

$\frac{\text{metres}}{\text{second}} \times \text{second} = \text{metres}$.

So the area under the graph represents the distance travelled.

So let required time to travel 75 metres be $(t+4)$ sec.

$$\text{So } \tfrac{1}{2}(4\times 10) + 10t = 75$$

$$t = \frac{55}{10}$$

$$\text{so } t+4 = 5\tfrac{1}{2} + 4$$

$$= 9\tfrac{1}{2} \text{ sec.}$$

To keep the equation simple we let the total time be $t+4$ rather than t but that means we have to add both the 4 seconds at the end.

29) $$\frac{5}{4x+1} = \frac{2x}{x^2+3}$$

This is a fairly standard "last question" — some tricky algebra that just requires careful working rather than much thinking.

Here we just cross-multiply

$$5(x^2+3) = 2x(4x+1)$$

$$5x^2 + 15 = 8x^2 + 2x$$

gather terms but keep to x^2 coefficient positive.

$$3x^2 + 2x - 15 = 0$$

The examiner gives you the clue that this won't factorise by asking for 3 sig. figs. and we've already had a factorising question anyway so this is a formula question.

For formula questions always follow this method. Don't shortcut because you will likely make a slip somewhere along the way.

$$3x^2 + 2x - 15 = 0$$

$$a = 3 \quad b = 2 \quad a = -15$$

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

and now substitute the values

$$x = \frac{-2 \pm \sqrt{2^2 - 4.3.(-15)}}{}$$

$$= \frac{-2 \pm \sqrt{184}}{6}$$

$$= \frac{-2 + \sqrt{184}}{6} \text{ or } \frac{-2 - \sqrt{184}}{6}$$

$$= 1.93 \qquad -2.59$$

to 3 sig. fig.