

Paper 3 June 21

1) n is 3 more than $\sqrt{a}$
 $n = \sqrt{a} + 3$

2) Largest number is 0.5

3) $3y = 3x - 2$
 $y = x - \frac{2}{3}$

when $x = 0$ $y = -\frac{2}{3}$

So y-intercept is $(0, -\frac{2}{3})$

4) $(x^2 - 64) = (x - 8)(x + 8)$

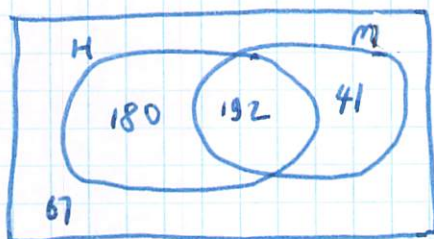
This is known as the difference of two squares. When we know what to look for they are easier to spot.

5) 6 numbers mean 10
 range 19
 let missing numbers be a and b
 $12 + 7 + 15 + 3 + a + b = 60$
 so $a + b = 23$

so try 3 and 20 range = 17
 try 2 and 21 range = 19

so missing numbers 2 and 19

6)



$480 \times 40\% = 192$
 $480 \times \frac{3}{8} = 180$
 Museum only = $480 - 180 - 192 - 67$
 = 41

So total income is

$67 \times 0 +$
 $192 \times 12.5 +$
 $180 \times 8 +$
 41×7
 = £4127

7) Jett : Koz

$2.6 : 1$ $3.6 \equiv \pounds 270$
 $\times 75$

$195 : 75$ 270

$195 - 75 = \pounds 120$

The secret to this is a clear layout.

8) Pressure = $\frac{198 \text{ pounds}}{\text{inch}^2}$

$\frac{198 \text{ pounds}}{\text{inch}^2} \times \frac{1 \text{ inch}^2}{6.25 \text{ cm}^2} \times \frac{0.45 \text{ kg}}{1 \text{ pound}}$

so cancelling out all the units
 we are left with kg/cm^2

$198 \times 0.45 / 6.25 = 14.256 \text{ kg/cm}^2$

9)

4	x
12	
	56

This is just a puzzle. fill in the gaps

	4	8
3	12	24
7	28	56

$4 : x = 1 : 2$

so shaded = $28 + 24$
 = 52
 unshaded = $56 + 12$
 = 68

shaded: unshaded
 $52 : 68$

$\rightarrow 13 : 17$

10) elevation is



plan is



11) Prime number 20 and 30

Possibilities are 23 and 29

$$\left. \begin{aligned} \frac{23}{125} &= 18.4\% \\ \frac{29}{125} &= 23.2\% \end{aligned} \right\} \text{either value}$$

12) 15 sides $\frac{360}{15} = 24^\circ$
interior angle = 156°

13) Volume box

$$\begin{aligned} &= 4 \times 26 \times 15 + \frac{1}{2} \pi 13^2 \times 15 \\ &= 15 (4 \times 26 + \frac{1}{2} \pi 13^2) \\ &= 15 (104 + 84\frac{1}{2} \pi) \\ &= 1560 + 1267.5 \pi \\ &= 5542 \text{ cm}^3 \end{aligned}$$

This is a standard question.
Make sure you understand this.
There are no surprises.

14) Phil is incorrect.
+10% -10% doesn't get
w back to the original price
Why not?

$$\frac{13.20}{1.1} = \text{£12 original price.}$$

$$\begin{aligned} \text{£13.20} - 10\% &= 13.2 \times 0.9 \\ &= \text{£11.88} \end{aligned}$$

$$\{ x \times 1.1 \times 0.9 = 0.99x \}$$

15.

A B C

Prob 0.5K 7K-0.15 2.5K

Now the total probability is 1.

$$\text{So } 0.5K + 7K - 0.15 + 2.5K = 1$$

collecting terms gives

$$10K = 1.15$$

$$\text{So } K = 0.115$$

$$\text{Prob B is } 7K - 0.15 =$$

$$0.115 \times 7 - 0.15$$

$$= 0.655$$

16. P is (2, 14) Q is (6, 8)
R is (2, 5)

$$\text{gradient PQ} = \frac{14-8}{2-6} = -\frac{3}{2}$$

$$\text{gradient QR} = \frac{8-5}{6-2} = \frac{3}{4}$$

For $\angle PQR$ to be a right angle
PQ must be perpendicular to QR.

$$m_1 m_2 = -1$$

$$-\frac{3}{2} \times \frac{3}{4} = -\frac{9}{8} \neq -1 \text{ but close}$$

17) $m^2 > 9$

$m > 3$ No possible solutions
given.

However $m < -3$

and $-\frac{7}{2}$ is a possible solution.

18) $w^1 \times w^0 = w^{1+0} = w$
simple.

19) $x^2 + y^2 = 11$
radius = $\sqrt{11}$
diameter = $2\sqrt{11}$

$$20) \frac{a}{b} = 3c \quad (1)$$

$$\frac{b}{c} = 2 \quad (2)$$

we need to eliminate b

$$\text{so } b = 2c \text{ from (2)}$$

put this into (1)

$$\frac{a}{2c} = 3c$$

$$\text{so } a = 6c^2$$

substitute $c = 8$

$$a = 6 \times 8 \times 8$$

$$= 384$$

21) Complete to chart

Age	freq.	width	Density
$0 \leq x < 5$	18	5	$18 \div 5 = 3.6$
$5 \leq x < 10$	23	5	$23 \div 5 = 4.6$
$10 \leq x < 20$	17	10	$17 \div 10 = 1.7$
$20 \leq x < 50$	21	30	$21 \div 30 = 0.7$

$$\text{frequency density} = \frac{\text{frequency}}{\text{class width}}$$

then plot the histogram.

This is a good question because it's an example of how actually to construct a histogram rather than giving one and asking questions.

22)

	p_0	p_1	p_2	p_3	$\dots$	p_n
Hor.	0	2	4	6	$\dots$	$2n$
ver.	1	2	3	4	$\dots$	$n+1$
Total	1	4	7	10	$\dots$	$3n+1$

$$\frac{\text{Horizontal}}{\text{Total}} = \frac{2n}{3n+1}$$

$$23) y = 16^x$$

$$\text{try } x = 2$$

$$y = 16^2$$

$$= 256$$

so point is $(2, 256)$

$$b) \frac{1}{16} = 16^x$$

$$\text{so } x = -1$$

$$24) a^b = 3$$

a inter b proper fraction

so we could have $9^{1/2} = 3$

or $27^{1/3} = 3$ etc.

$$25) (x-3)(x+2)(x+5)$$

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

$$= x^3 - x^2 - 6x$$

$$+ 5x^2 - 5x - 30$$

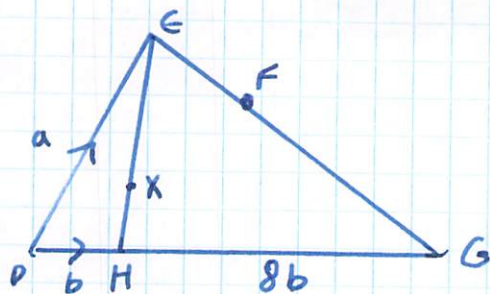
$$= x^3 + 4x^2 - 11x - 30$$

26)

	Core A	Core B
Area	2	4.5
Radius	$\sqrt{2}$	$\sqrt{4.5}$
	1	$\frac{\sqrt{4.5}}{\sqrt{2}}$
	1	$\frac{\sqrt{2 \times 2.25}}{\sqrt{2}}$
	1	$\sqrt{2.25}$
	1	1.5

or could I could have immediately calculated this.

27)



$$\text{Now } \vec{a} + \vec{EH} = \vec{b}$$

$$\vec{EH} = \vec{b} - \vec{a}$$

$$EH = b - a$$

$$\text{Now } EX : XM : EH$$

$$3 : 1 : b - a$$

$$\text{So } \frac{3}{4}(b-a) : \frac{1}{4}(b-a)$$

$$DX = DE + EX$$

$$DX = a + \frac{3}{4}(b-a)$$

$$= \frac{1}{4}a + \frac{3}{4}b$$

b) Is DXF a straight line.

$$\text{Now } DE + EG = DG$$

$$a + EG = 9b$$

$$EG = 9b - a$$

$$EF : FG : EG$$

$$1 : 3 : 9b - a$$

$$\frac{9b-a}{4} : \frac{3}{4}(9b-a) : 9b-a$$

$$DF = DE + EF$$

$$DF = a + \frac{9b-a}{4}$$

$$= \frac{3}{4}a + \frac{9}{4}b$$

$$= 3\left(\frac{1}{4}a + \frac{3}{4}b\right)$$

$$\text{So } DF = 3DX$$

i.e. same gradient and w

X is a common point

DXF is a straight line.

28)

$$a = 472$$

$$b = 158$$

} 3 sig. fig.

$$\text{Upper bound } \frac{a}{b}$$

$$= \frac{\text{max } a}{\text{min } b}$$

$$= \frac{472.5}{157.5}$$

$$= 0.03$$