

Hyper 2 Nov. 22
(calculator)

1) $\frac{4^6 - 11}{\sqrt{625} - 225} = -20.425$

2) $(3.1 \times 10^3)^2 = 9.61 \times 10^{18}$

3) $y = 3x - 6$
at y-intercept $x = 0$
 $y = -6$ so point is $(0, -6)$

4) $a \times b^x = c$ so $a = \frac{c}{b^x}$

5) $12600 = 2^3 \times 3^2 \times 5^2 \times 7^1$
 $14112 = 2^5 \times 3^2 \times 5^0 \times 7^2$
HCF $= 2^3 \times 3^2 \times 5^0 \times 7^1$
 $= 504$

6) a) Tees are 48%
Cotters are 42%
Difference = 6%
 $= \frac{24000}{100} \times 6 = 1440$

b) These are percentages so we cannot declare actual numbers.

7) $k \in \mathbb{N}$
 $40 < k < 50$
 $\sqrt[3]{k} \approx 3$
 $k < (3.5)^3$
 $k < 42.875$
 $k = 42$

b) $x^2 = 100$
 $x = \pm \sqrt{100}$
 $= \pm 10$

NB. Although $\sqrt{\quad}$ strictly means the positive value only - otherwise $\sqrt{\quad}$ isn't a function - we add the $\pm$ when taking the square root.

8) w, x, y $\in \mathbb{N}$

$4w + 4x + 4y = 80$
 $w + x + y = 20$

To get max. vol. we set $w = x = y$ but compare with

$5 + 7 + 8 = 20$
 $5 \times 7 \times 8 = 280.$

so $w = 5$ $x = 7$ $y = 8$
satisfies conditions

b) Surface area $= 6 \times (3a)^2$
 $= 54a^2$

9) $47^{\text{th}} \Delta = 1128$
 $48^{\text{th}} \Delta = 1176$
difference = 48

so $47\Delta + 48 = 48^{\text{th}} \Delta$

so $48\Delta + 49 = 49^{\text{th}} \Delta$
 $= 1225$

Also I know $\frac{1}{2} 49 \times 50 = 1225$

10)

	0	1	2	3	4	5
A+B	3	8	13	18	23	28
A	1	2	3	4	5	6
B	2	6	10	14	18	22

$n^{\text{th}} B \text{ term is } 4n + 2$

$$11) a) \frac{1.2 \text{ litres}}{\text{min}} \times 20 \text{ min}$$

$$= 24 \text{ litres}$$

$$40 - 24 = 16 \text{ litres}$$

Q.E.D.

b) hill starts after

$$20 + 3 = 23 \text{ minutes}$$

gradient =

$$= \frac{(40 - 20)}{(15 - 5)}$$

$$= 2 \text{ litres/min.}$$

{ AQA answer is wrong! }

$$12) 6x + x + x + 5x + 6x + 6x + x$$

$$= 98.8$$

$$26x = 98.8$$

Rectangle is $14x$ perimeter

$$14x = \frac{98.8}{26} \times 14 = 53.2$$

$$13) ED = \frac{7 \times 6}{42} = 10$$

$$EH^2 = 10^2 - 6^2$$

$$EH = 8$$

$$\text{Area trapezium} = \frac{1}{2} (7.5 + 13.5) \times 8$$

$$= 84 \text{ cm}^2$$

$$14) \text{ Profit} = £137500 \times 8\% = £11000$$

$$100\% \text{ deposit} = \frac{11000}{40} \times 100$$

$$= £27500$$

$$6 \times £27500 = £165000$$

$$15) 1 \text{ cm}^2 = 100 \text{ mm}^2$$

$$16) y = x^3 + 1$$

$$17) u_1 = 1$$

$$u_2 = \frac{20}{1+3} = 5$$

$$u_3 = \frac{20}{5+3} = \frac{5}{2}$$

18) y As drawn with

Lower = 85

Upper = 126

Median = 99

LQ = 96

UQ = 109

b) Home median is 106

Away median is 99

so scored more Home

c) Away scores have a lower IQR, so more consistent.

$$19) 3x^2 + x - 5 = 0$$

$$a = 3 \quad b = 1 \quad c = -5$$

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

$$= \frac{-1 \pm \sqrt{1 + 60}}{6}$$

$$= \frac{+ \sqrt{61} - 1}{6} = 1.135$$

$$\text{or } \frac{- \sqrt{61} - 1}{6} = -1.468$$

$$20) P(\text{juice} / \text{fruit} / \text{valued})$$

$$= \frac{3}{7} \times \frac{2}{5} \times \frac{4}{11}$$

$$= \frac{24}{385} > 5\%$$

$$21) f(x) = \frac{3x+9}{5}$$

$$g(x) = 6x-1$$

$$g(f(x)) = 6\left(\frac{3x+9}{5}\right) - 1$$

$$= \frac{18x+49}{5}$$

$$g(f(2)) = \frac{18 \times 2 + 49}{5}$$

$$= \frac{85}{5} = 17$$

$$b) y = \frac{3x+9}{5}$$

$$5y-9 = 3x$$

$$x = \frac{5y-9}{3}$$

$$f^{-1}(x) = \frac{5x-9}{3}$$

$$f^{-1}(8) = \frac{40-9}{3}$$

$$= \frac{31}{3} \neq 11$$

$$22) x^3 - 49x = x(x^2 - 49)$$

$$= x(x+7)(x-7)$$

$$23) \text{ no. students}$$

$$= \text{freq. density} \times \text{how wide}$$

block 1	$1\frac{1}{2} \times 6 = 9$
block 2	$3\frac{1}{2} \times 4 = 14$
block 3	$5 \times 2 = 10$
block 4	$4.5 \times 4 = 18$
block 5	$2.5 \times 4 = 10$

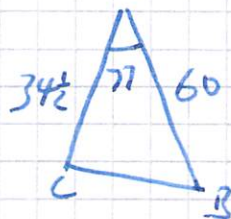
$$\text{Gt. Mean Time} =$$

block 1	$9 \times 3 = 27$
block 2	$14 \times 8 = 112$
block 3	$10 \times 11 = 110$
block 4	$18 \times 14 = 252$
block 5	$10 \times 18 = 180$

$$\frac{681}{61} = 11.2 \text{ hr.}$$

23) This is an estimate because we're using midpoints as a best guess.

24) This is a cosine rule



$$CB^2 = 34\frac{1}{2}^2 + 60^2 - 2 \times 34\frac{1}{2} \times 60 \times \cos 77$$

$$CB = 62.1 \text{ so further away.}$$

$$25) \begin{aligned} \overrightarrow{QP} &= a \\ \overrightarrow{PV} &= b \\ \overrightarrow{VW} &= -\frac{1}{3}a \end{aligned}$$

$$\begin{aligned} \overrightarrow{QW} &= a + b - \frac{1}{3}a \\ &= \frac{2}{3}a + b \end{aligned}$$

$$\overrightarrow{WV} = \frac{1}{3}a$$

$$\overrightarrow{VX} = \frac{1}{2}b$$

$$\overrightarrow{WX} = \frac{1}{3}a + \frac{1}{2}b$$

Now

$$\overrightarrow{QW} = 2 \times \overrightarrow{WX}$$

i.e. same gradient/direction.
and as W is a common
point QWX is a straight line.

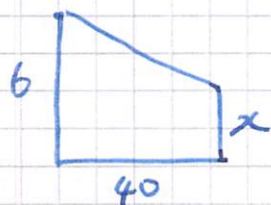
26) Area under graph =
Speed $\times$ time = distance.

Area trapezium given

$$= \frac{1}{2}(100 + 90) \times 6 = 570 \text{ m.}$$

Remaining distance = 230 metres.

Consider the end trapezium.



$$\text{Area} = \frac{1}{2}(6 + x)40 = 230 \text{ m.}$$

$$x = 5\frac{1}{2} \text{ m/s.}$$

27) $P(\text{both boys})$

$$\frac{n}{25} \times \frac{n-1}{24} = \frac{7}{20}$$

$$n^2 - n = \frac{7 \times 25 \times 24}{20}$$

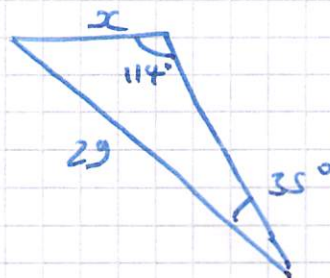
$$n^2 - n - 210 = 0$$

$$(n-15)(n+14) = 0$$

$$n = 15$$

check $\frac{15}{25} \times \frac{14}{24} = \frac{7}{20} \checkmark$

28)



$$\frac{x}{\sin 35} = \frac{29}{\sin 114}$$

$$\begin{aligned} x &= \frac{29 \sin 35}{\sin 114} \\ &= 18.2 \text{ cm.} \end{aligned}$$