NZQA Level 1 Mathematical Reasoning 2025

1) a) Surface of cuboid: $x = 7$.

$2x - 1 = 13$
$3x + 2 = 23$
$3x = 21$

Surface $= 2 \times (13 \times 23 + 23 \times 21 + 21 \times 13)$
$= 2 \times (299 + 483 + 273)$
$= 2 \times 1058$
$= \underline{\underline{2110}}$ (units)

b) The diagram's a bit confusing but this is just solving 2 simultaneous equations:

$3x - y = 2$ ①
$x + 3y = 19$ ②

From ②: $x = 19 - 3y$

use this in ①: $3(19 - 3y) - y = 2$

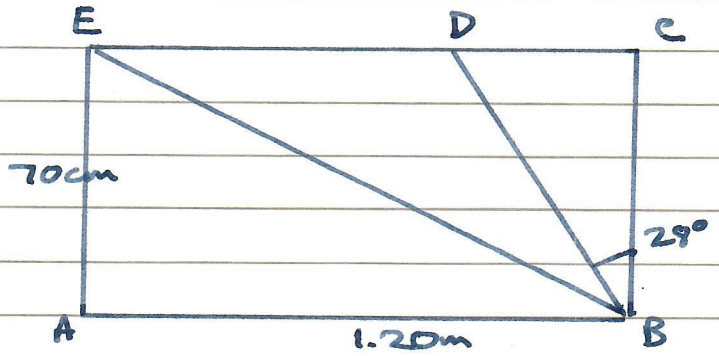
$57 - 9y - y = 2$
$57 - 10y = 2$
$10y = 55$
$\underline{\underline{y = 5.5}}$

in ②: $x + 16.5 = 19$
$\underline{\underline{x = 2.5}}$

So Q is the point $\underline{\underline{(2.5, 5.5)}}$

(or use $3 \times$ ① + ② to get $10x = 25$, etc)

c)



Pythagoras: $EB = \sqrt{70^2+120^2} = 138.92\text{cm}.$

Trig: $\frac{CB}{DB} = \frac{70}{DB} = \cos 28°$

$$DB = \frac{70}{\cos 28°} = 79.28\text{cm}.$$

Trig: $\frac{CD}{CB} = \frac{CD}{70} = \tan 28°$

$$CD = 70 \tan 28° = 37.22\text{cm}$$

So Perimeter of BDE = $138.92+79.28+37.22$
$= \underline{300.98\text{ cm}}$

d) i) This is 'numeric sequences', ahead of 'differentiation' at Level 2.
(though actually it isn't)

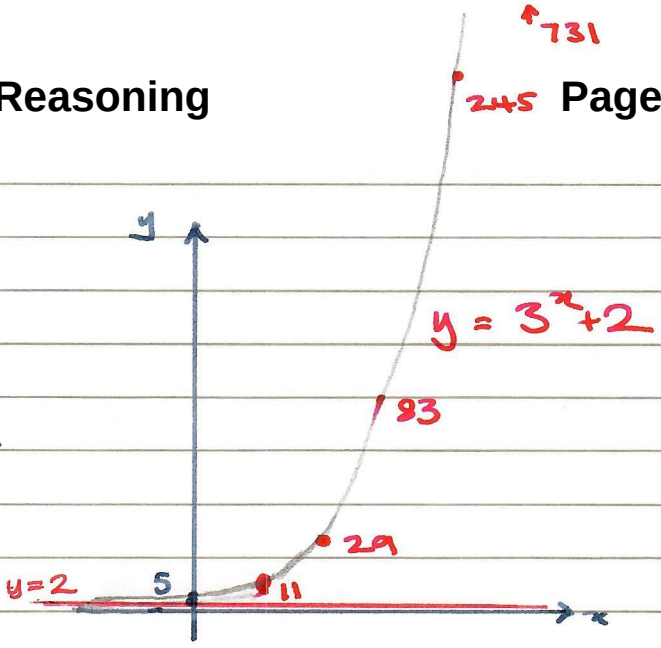
x	1	2	3	4	5
y	11	29	83	245	731

I think we're supposed to just notice:

11 is $9+2$
29 is $27+2$
83 is $81+2$
} so 3^n+2? {
245 is $243+2 = 3^5+2$
731 is $729+2 = 3^6+2$

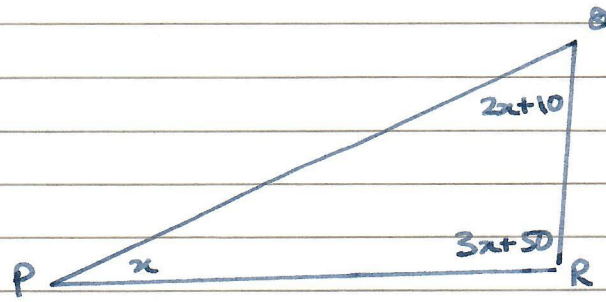
So we conclude $\underline{y(x) = 3^x+2.}$

ii) Note we draw the graph for all values of x:



- The graph is exponential
- It crosses the y-axis at $(0, 5)$ $(5 = 3^0 + 2)$
- As $x \to \infty$ $y \to \infty$
- As $x \to -\infty$ $y \to 2$ from above
- The curve never intercepts the x-axis but has $y=2$ as an assymptote as $x \to -\infty$.

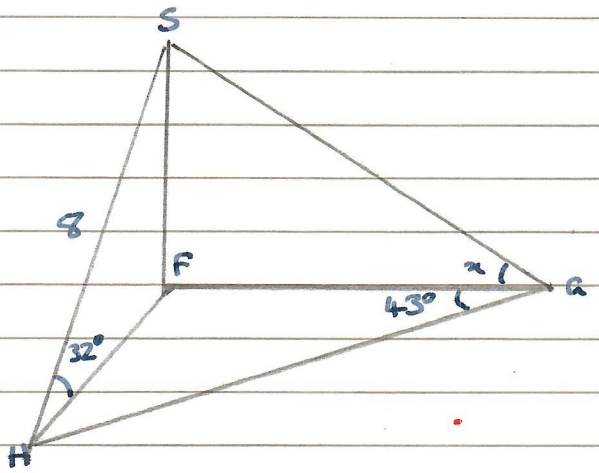
2)



Angles of a Δ sum to $180°$:

$$x + 2x + 10 + 3x + 50 = 180$$
$$6x + 60 = 180$$
$$6x = 120$$
$$x = 20$$

b)



Find $\angle SGF = x$ by trig. in ΔSGF.

$\frac{SF}{8} = \sin 32°$: $SF = 8\sin 32° = 4.239\text{cm}$

$\frac{FH}{8} = \cos 32°$: $FH = 8\cos 32° = 6.784\text{cm}$

$\frac{FH}{FG} = \tan 43°$: $FG = \frac{FH}{\tan 43°} = \frac{6.784}{\tan 43°} = 7.275\text{cm}$

So in ΔSGF, $\tan x = \frac{SF}{FG} = \frac{4.239}{7.275}$

So $x = \tan^{-1}(0.5827) = 30.23°$.

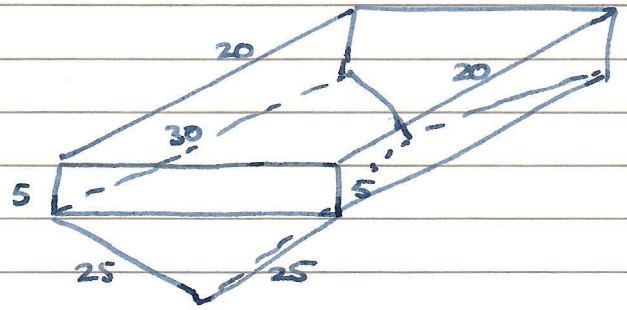
c) $15x^2 = 2 - 7x$

$15x^2 + 7x - 2 = 0$

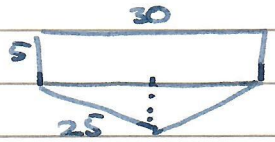
$(5x - 1)(3x + 2) = 0$

So $x = -\frac{2}{3}$ or $\frac{1}{5}$

a)



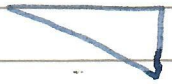
Volume of hole =  × 20m

Area of 

Area of  = $5 \times 30 m^2 = 150 m^2$

Area of 

$h^2 = 25^2 - 15^2$: $h = 20$ (Pythagoras)

 = $\frac{15 \times 20}{2} = 150 m^2$

 = $150 + 2 \times 150 = 450 m^2$

So volume of the hole = $450 \times 20 = \underline{\underline{9000 m^3}}$

Weight of earth = $800 \times 9000 = 7200000$ kg

No of trips = $\frac{7200000}{45000} = \underline{\underline{160}}$

3) a) i) Line L passes through $(4,3)$ and $(5,0)$

so its gradient m is -3.

Eq^n is $y = -3x + c$

Subs. for point $(5,0)$:

$$0 = -15 + c$$
$$c = 15$$

So L is $y = -3x + 15$

ii) Parabola has axis at $x = -1$
and roots $x = -5$ and 3

So its equation is $a(x+5)(x-3) = y$

Subs the point $(-4,6)$:

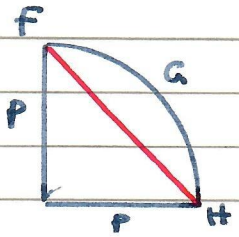
$$a(4)(-4) = 6$$
$$a = \frac{-6}{16} = -\frac{3}{8}$$

So the parabola is $y = -\frac{3}{8}(x+5)(x-3)$

i.e. $y = -\frac{3}{8}(x^2 + 2x - 15)$

$$y = -\frac{3}{8}x^2 - \frac{3}{4}x + \frac{45}{8}$$

b)



Line FH = $\sqrt{2}p$ (Pythagoras)

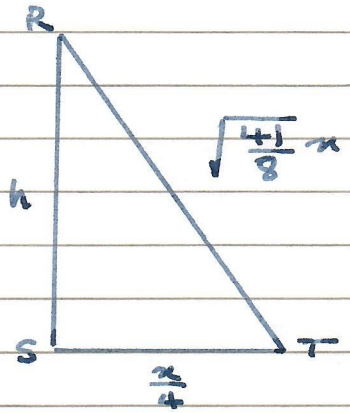
Curve FGH = $\frac{\pi}{4}p$ (using radians)

or $\frac{2\pi p}{4}$ (using circumference and quartering)

So FGH − FH = $\left(\frac{\pi}{4} - \sqrt{2}\right)p$

= $\underline{0.1566p}$

c)



RS = $\sqrt{-\frac{x^2}{16} + \left(\sqrt{\frac{41}{8}}\right)^2 x^2}$ (note I've written it as $a^2 = -b^2 + c^2$)

= $\sqrt{-\frac{x^2}{16} + \frac{41}{8}x^2}$

= $x\sqrt{-\frac{1}{16} + \frac{82}{16}}$ = $x\sqrt{\frac{81}{16}}$ = $\frac{9}{4}x$.

So Area of RST = $\frac{1}{2} \cdot \frac{x}{4} \cdot \frac{9x}{4} = 72\text{ cm}^2$

$\frac{9x^2}{32} = 72$: $x^2 = \frac{72 \times 32}{9} = 2^8$ $x = 2^4 = \underline{16}$ (cm)