1 a When $h = 10,\ d = \dfrac{10}{5} + 6$

$= 8$

b When $h = 8.5,\ d = \dfrac{8.5}{5} + 6$

$= 7.7$

c The diameter of the bottom of the glass can be calculated when $h = 0$.

$\therefore d = \dfrac{0}{5} + 6$

$= 6$

The diameter of the bottom of the glass is 6 cm.

d When $d = 9,\ 9 = \dfrac{h}{5} + 6$

$\therefore\ 3 = \dfrac{h}{5}$

$\therefore\ h = 15$

The height of the glass is 15 cm.

2 a When $n = 100,\ C = 108$,

$\therefore\ 108 = 100a + b \qquad \ldots \boxed{1}$

When $n = 120,\ C = 100$,

$\therefore\ 100 = 120a + b \qquad \ldots \boxed{2}$

Subtract $\boxed{2}$ from $\boxed{1}$

$8 = -20a$

$\therefore\ a = \dfrac{-8}{20}$

$= -0.4$

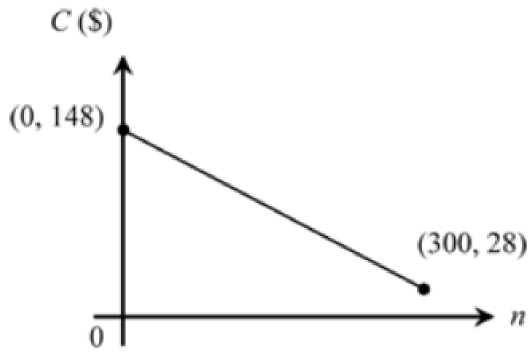
Substitute $a = -0.4$ in $\boxed{1}$

$108 = 100 \times -0.4 + b$

$= -40 + b$

$\therefore\ b = 148$

b $C = -0.4n + 148,\ 0 \le n \le 300$



c When $n = 200,\ C = -0.4 \times 200 + 148 = 68$

If 200 jackets are made, each jacket will cost $\$68$ to manufacture.

d When $C = 48.8,\ 48.8 = -0.4n + 148$

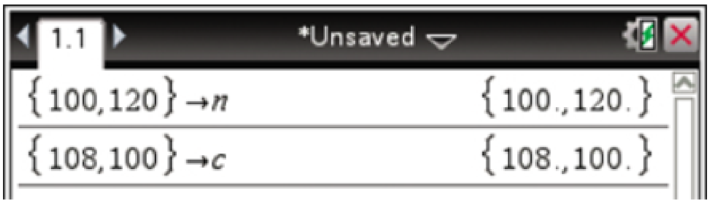
$\therefore\ 0.4n = 99.2$

$\therefore\ n = 248$

If the cost of manufacturing each jacket is $\$48.80$, 248 jackets are produced in the run.

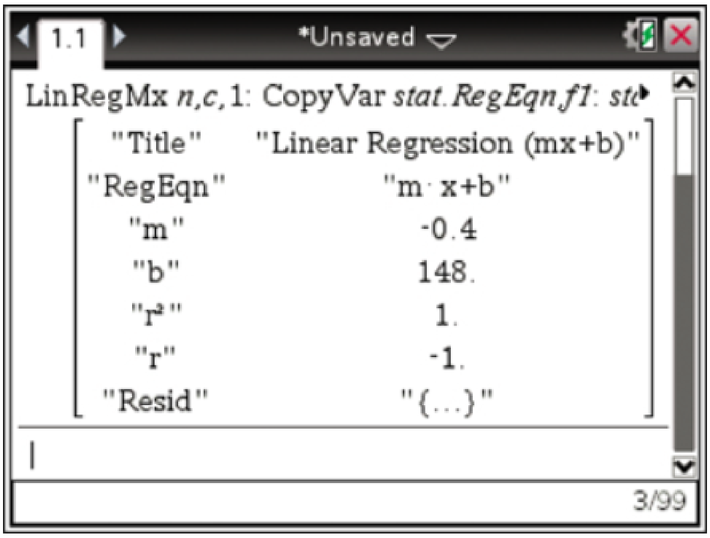
CAS calculator techniques for Question 4

TI: In the Calculator page type $\{\mathbf{100},\mathbf{120}\}\to\mathbf{n}$ then ENTER followed by $\{\mathbf{108},\mathbf{100}\}\to\mathbf{c}$ then ENTER. Press **Menu** $\to$ **6**: **Statistics** $\to$ **1**: **Stat Calculations**$\to$**3Linear Regression** (**mx** + **b**). Set X List to **n** and Y List to **c**.

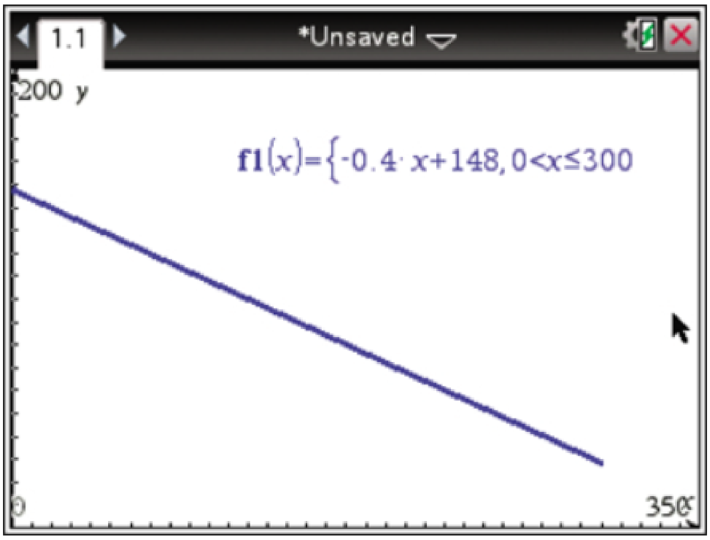


The equation of the line is $C = -0.4n + 148$

In a Graphs page input $-\mathbf{0.4}\boldsymbol{x} + \mathbf{148}|\mathbf{0}<\boldsymbol{x}\leq\mathbf{300}$ into $\boldsymbol{f}\mathbf{1}$ then ENTER. In a Calculator page type $\boldsymbol{f}\mathbf{1(200)}$ to yield a value of 68.



To answer part **d** sketch $\boldsymbol{f}\mathbf{2} = \mathbf{48.8}$. Press **Menu**$\to$**6: Analyze Graph**$\to$**4**:**Intersection**



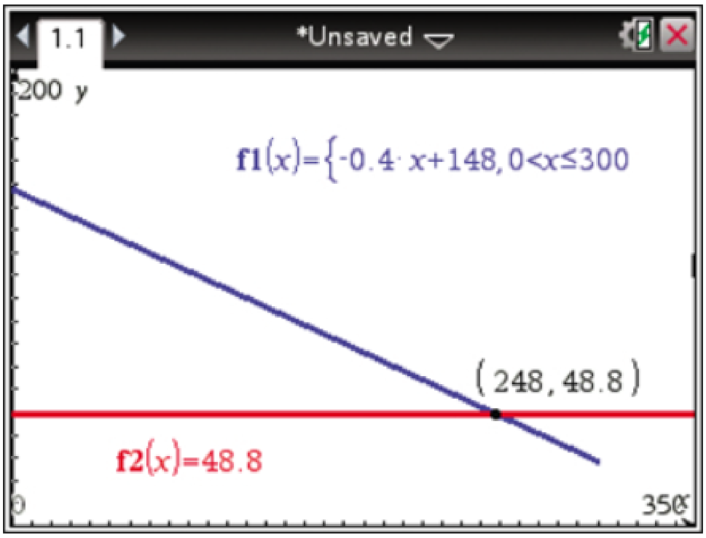
CP: In the Main application type $\{\mathbf{100},\mathbf{120}\}$**Bn** then EXE followed by $\{\mathbf{108},\mathbf{100}\}$**Bc** then EXE. In the (tab of the Keyboard select **LinearReg** and complete the command as **LinearReg n,c** followed by EXE. Tap

Action$\to$**Command**$\to$**DispStat**

The equation of the line is $C = -0.4n + 148$

In a Graph&Table application input

$-\mathbf{0.4}\boldsymbol{x}+\mathbf{148}|\mathbf{0}<\boldsymbol{x}\leq\mathbf{300}$ into $\boldsymbol{y}\mathbf{1}$ then EXE. Tap $ then **Analysis**$\to$**G**$-$**Solve**$\to$**y** $-$ **Cal** and input 200 as the x-value to yield a value of 68.



To answer part **d** sketch $y2 = 48.8$. Tap

Analysis→G- Solve→Intersect

3 a i When $n = 180,\ A = 180 - \dfrac{360}{180}$

$= 178$

ii When $n = 360,\ A = 180 - \dfrac{360}{360}$

$= 179$

iii When $n = 720,\ A = 180 - \dfrac{360}{720}$

$= 179.5$

iv When $n = 7200,\ A = 180 - \dfrac{360}{7200}$

$= 179.95$

b i As n becomes very large, A approaches 180.

ii As n becomes very large, the shape of the polygon approaches that of acircle.

c When $A = 162,\ 162 = 180 - \dfrac{360}{n}$

$\therefore\ \dfrac{360}{n} = 18$

$\therefore\ n = \dfrac{360}{18}$

$= 20$

d $A = 180 - \dfrac{360}{n}$

$\therefore \dfrac{360}{n} = 180 - A$

$\therefore n = \dfrac{360}{180 - A}$

e For an octagon, $n = 8$

$\therefore\ A = 180 - \dfrac{360}{8}$

$= 135$

At the point where the two octagons and the third regular polygon meet, the three angles sum to $360°$,

$\therefore 135 + 135 + x = 360$

where $x°$ is the size of the interior angle of the third regular polygon.

$\therefore 270 + x = 360$

$\therefore x = 90$

Thus the third regular polygon is a square.

4 a Volume of hemisphere, $V_H = \frac{1}{2} \times \frac{4}{3}\pi r^3 = \frac{2}{3}\pi t^3$

Volume of cylinder, $V_{CY} = \pi r^2 h = \pi t^2 s$

Volume of cone, $V_{co} = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi t^2 w$

b i $If V_H = V_{CY} = V_{CO}$

then $\frac{2}{3}\pi t^3 = \pi t^2 s \quad \ldots \boxed{1}$

and $\pi t^2 s = \frac{1}{3}\pi t^2 w \quad \ldots \boxed{2}$

From $\boxed{1}$ $\frac{t^3}{t^2} = \frac{3}{2}s$

From $\boxed{2}$ $w = \frac{\pi t^2 s}{\frac{1}{3}\pi t^2}$

$= 3s \qquad \therefore \quad w : s : t = 3s : s : \frac{3}{2}s$

$= 3 : 1 : \frac{3}{2}$

$= 6 : 2 : 3$

ii If $w + s + t = 11$

then $3s + s + \frac{3}{2}s = 11$

$\therefore \frac{11}{2}s = 11$

$\therefore s = 2$

$w = 3 \times 2$

$= 6$

$t = \frac{3}{2} \times 2$

$= 3$

Total volume $= V_H + V_{CY} + V_{CO}$

$= \frac{2}{3}\pi t^3 + \pi t^2 s + \frac{1}{3}\pi t^2 w$

$= \frac{2}{3}\pi \times 3^3 + \pi \times 3^2 \times 2 + \frac{1}{3}\pi \times 3^2 \times 6$

$= 18\pi + 18\pi + 18\pi$

$= 54\pi$

The total volume is 54π cubic units.

5 a When $n = 1$, $P = -9000$,

$\therefore -9000 = a + b \quad \ldots \quad \boxed{1}$

When $n = 5$, $P = 15\,000$

$\therefore 15\,000 = 5a + b \quad \ldots \quad \boxed{2}$

Subtract $\boxed{1}$ from $\boxed{2}$

$\therefore 24\,000 = 4a$

$\therefore 6000 = a$

Substitute $a = 6000$ in $\boxed{1}$

$$\therefore \quad -9000 = 6000 + b$$
$$\therefore \quad -15\,000 = b$$

b $P = 6000n - 15\,000$

When $n = 12,\ P = 6000 \times 12 - 15\,000$
$= 57\,000$

The profit is $\$57\,000$.

c When $P = 45\,000,\ 45\,000 = 6000n - 15\,000$
$\therefore \quad 60\,000 = 6000n$
$\therefore \quad 10 = n$

The profit will be $\$45\,000$ at the end of 2016, after 10 years of operation.

6 a Perimeter of rectangle $= 2(3x + x)$
$= 8x$

The perimeter of the rectangle is $8x$ cm.

b Perimeter of square $=$ length of wire $-$ perimeter of rectangle
$= 28 - 8x$

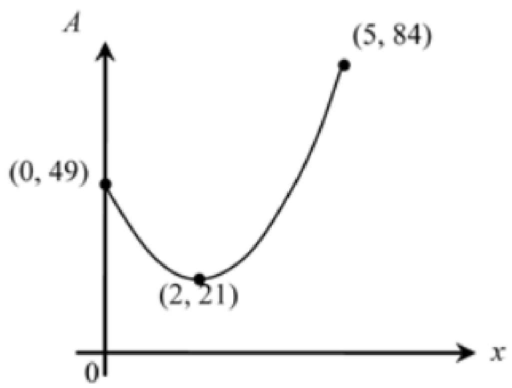
The perimeter of the square is $(28 - 8x)$ cm.

c Side length of square $= \dfrac{28 - 8x}{4}$
$= 7 - 2x$

The length of each side of the square is $(7 - 2x)$ cm.

d $A =$ area of rectangle $+$ area of square
$= 3x \times x + (7 - 2x)^2$
$= 3x^2 + 49 - 28x + 4x^2$
$= 7x^2 - 28x + 49$
$= 7(x^2 - 4x + 7)$ as required .

e



f $A = 7x^2 - 28x + 49$

Minimum value occurs at $x = \dfrac{-b}{2a}$, where $a = 7$ and $b = -28$
$= \dfrac{28}{14}$
$= 2$

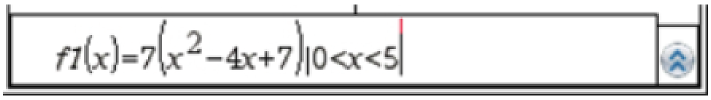
When $x = 2,\ A = 7(2^2 - 4 \times 2 + 7)$
$= 21$

A has a minimum value of 21 when $x = 2$.

CAS calculator techniques for Question 9

TI: Sketch the graph of

$\boldsymbol{f1(x)=7(x\text{^}2-4x+7)|0<x<5}$

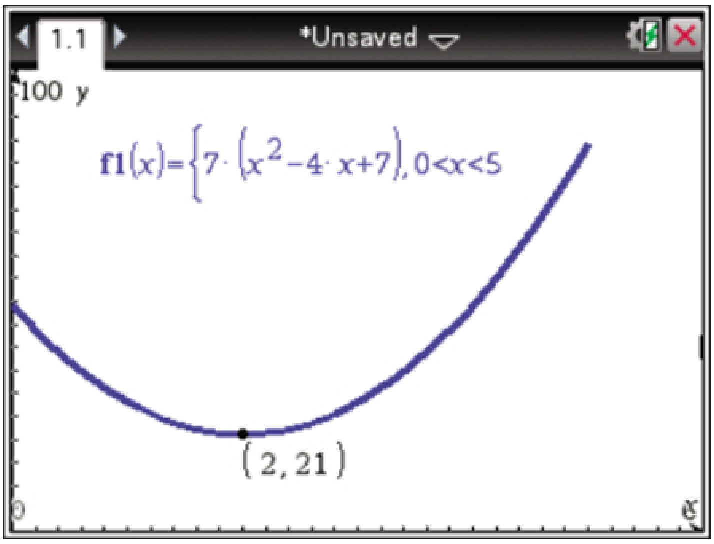


Press **Menu** $\rightarrow$ $\mathbf{6{:}\ AnalyzeGraph \rightarrow 2{:}\ Minimum}$ to yield the minimum value.

CP: Sketch the graph of

$\boldsymbol{y1(x)=7(x\text{^}2-4x+7)|0<x<5}$

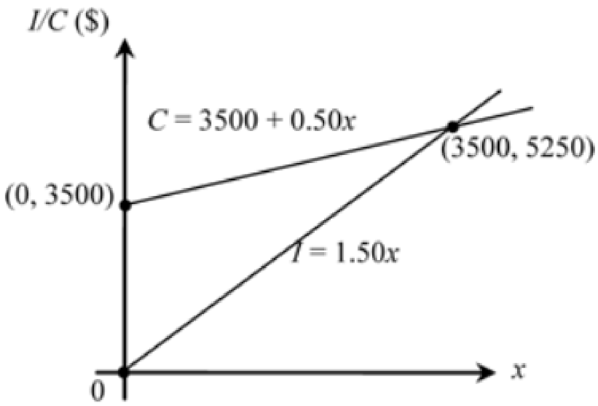
Press $\mathbf{Analysis \rightarrow G{-}Solve \rightarrow Min}$ to yield the minimum value.



7 **a** $C = 3500 + 0.50x$

b $I = 1.50x$

c



d When $I = C$, $150x = 3500 + 0.50x$

$\therefore \quad x = 3500$

Income equals cost of production when 3500 plates have been sold.

e

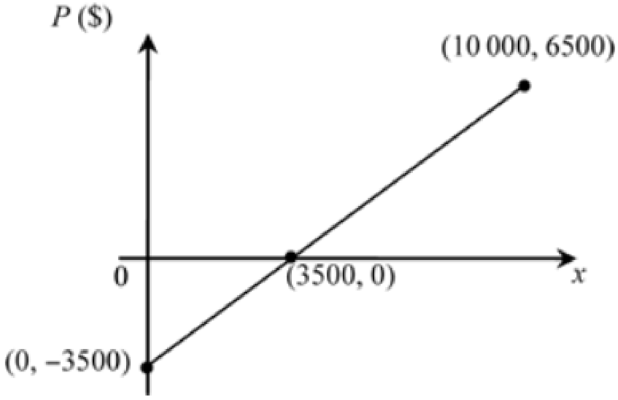
$$\begin{aligned} I - C &= 2000 \\ \therefore 1.50x - (3500 + 0.50x) &= 2000 \\ \therefore \quad x - 3500 &= 2000 \\ \therefore \quad x &= 5500 \end{aligned}$$

A profit of \$2000 is made when 5500 plates are sold.

f

$$\begin{aligned} P &= I - C \\ &= 1.50x - (3500 + 0.50x) \\ &= x - 3500 \end{aligned}$$

P represents the profit made.



8 a i

$$\sqrt{7x-5}-\sqrt{2x}=\sqrt{15-7x}$$
$$\Rightarrow \quad (\sqrt{7x-5}-\sqrt{2x})^2=(\sqrt{15-7x})^2$$
$$\Rightarrow \quad (\sqrt{7x-5})^2-2(\sqrt{7x-5})(\sqrt{2x})+(\sqrt{2x})^2=15-7x$$
$$\Rightarrow \quad 7x-5-2\sqrt{(7x-5)(2x)}+2x=15-7x$$
$$\Rightarrow \quad 9x-5-2\sqrt{14x^2-10x}=15-7x$$
$$\Rightarrow \quad 9x-5-15+7x=2\sqrt{14x^2-10x}$$
$$\Rightarrow \quad 16x-20=2\sqrt{14x^2-10x}$$
$$\Rightarrow \quad 8x-10=\sqrt{14x^2-10x},\ \text{as required.}$$

ii

$$(8x-10)^2=(\sqrt{14x^2-10x})^2$$
$$\therefore \quad 64x^2-160x+100=14x^2-10x$$
$$\therefore \quad 64x^2-160x+100-14x^2+10x=0$$
$$\therefore \quad 50x^2-150x+100=0$$
$$\therefore \quad x^2-3x+2=0, \text{as required.}$$

iii Consider $\sqrt{7x-5}-\sqrt{2x}=\sqrt{15-7x}$

When $x=1$, $\text{LHS}=\sqrt{7\times 1-5}-\sqrt{2\times 1}$
$=\sqrt{2}-\sqrt{2}=0$
$\text{RHS}=\sqrt{15-7\times 1}$
$=\sqrt{8}\neq 0$

Hence LHS $\neq$ RHS and $x=1$ is not a solution.

When $x=2$, $\text{LHS}=\sqrt{7\times 2-5}-\sqrt{2\times 2}$
$=\sqrt{9}-\sqrt{4}$
$=3-2=1$
$\text{RHS}=\sqrt{15-7\times 2}$
$=\sqrt{1}=1$

Hence LHS $=$ RHS and $x=2$ is a solution.

b i

$$\sqrt{x+2}-2\sqrt{x}=\sqrt{x+1}$$
$$\Rightarrow \quad (\sqrt{x+2}-2\sqrt{x})^2=(\sqrt{x+1})^2$$
$$\Rightarrow \quad x+2-4\sqrt{x+2}\sqrt{x}+4x=x+1$$
$$\Rightarrow \quad 5x+2-4\sqrt{(x+2)x}=x+1$$
$$\Rightarrow \quad 5x+2-x-1=4\sqrt{x^2+2x}$$
$$\Rightarrow \quad 4x+1=4\sqrt{x^2+2x}$$
$$\Rightarrow \quad (4x+1)^2=(4\sqrt{x^2+2x})^2$$
$$\Rightarrow \quad 16x^2+8x+1=16(x^2+2x)$$
$$\Rightarrow \quad 16x^2+8x+1=16x^2+32x$$
$$\Rightarrow \quad 1=24x$$
$$\Rightarrow \quad x=\frac{1}{24}$$

Consider $\sqrt{x+2}-2\sqrt{x}=\sqrt{x+1}$

$$\text{When } x=\frac{1}{24}, \qquad \text{LHS}=\sqrt{\frac{1}{24}+2}-2\sqrt{\frac{1}{24}}$$
$$=\sqrt{\frac{49}{24}}-\frac{2}{2\sqrt{6}}$$
$$=\frac{7}{2\sqrt{6}}-\frac{2}{2\sqrt{6}}=\frac{5}{2\sqrt{6}}$$
$$\text{and} \qquad \text{RHS}=\sqrt{\frac{1}{24}+1}$$
$$=\sqrt{\frac{25}{24}}$$
$$=\frac{5}{2\sqrt{6}}$$

Hence LHS $=$ RHS and $x=\frac{1}{24}$ is a solution.

ii

$$2\sqrt{x+1}+\sqrt{x-1}=3\sqrt{x}$$
$$\Rightarrow \quad (2\sqrt{x+1}+\sqrt{x-1})^2=(3\sqrt{x})^2$$
$$\Rightarrow \quad 4(x+1)+4\sqrt{x+1}\sqrt{x-1}+x-1=9x$$
$$\Rightarrow \quad 4x+4+4\sqrt{(x+1)(x-1)}+x-1=9x$$
$$\Rightarrow \quad 5x+3+4\sqrt{x^2-1}=9x$$
$$\Rightarrow \quad 4\sqrt{x^2-1}=4x-3$$
$$\Rightarrow \quad (4\sqrt{x^2-1})^2=(4x-3)^2$$
$$\Rightarrow \quad 16(x^2-1)=16x^2-24x+9$$
$$\Rightarrow \quad 16x^2-16=16x^2-24x+9$$
$$\Rightarrow \quad 24x=25$$
$$\Rightarrow \quad x=\frac{25}{24}$$

Consider $2\sqrt{x+1}+\sqrt{x-1}=3\sqrt{x}$

$$\text{When } x=\frac{25}{24}, \qquad \text{LHS}=2\sqrt{\frac{25}{24}+1}+\sqrt{\frac{25}{24}-1}$$
$$=2\sqrt{\frac{49}{24}}+\sqrt{\frac{1}{24}}$$
$$=\frac{2\times 7}{2\sqrt{6}}+\frac{1}{2\sqrt{6}}$$
$$=\frac{15}{2\sqrt{6}}$$
$$\text{and} \qquad \text{RHS}=3\sqrt{\frac{25}{24}}$$
$$=\frac{3\times 5}{2\sqrt{6}}$$
$$=\frac{15}{2\sqrt{6}}$$

Hence LHS $=$ RHS and $x=\frac{25}{24}$ is a solution.

CAS calculator techniques for Question 12

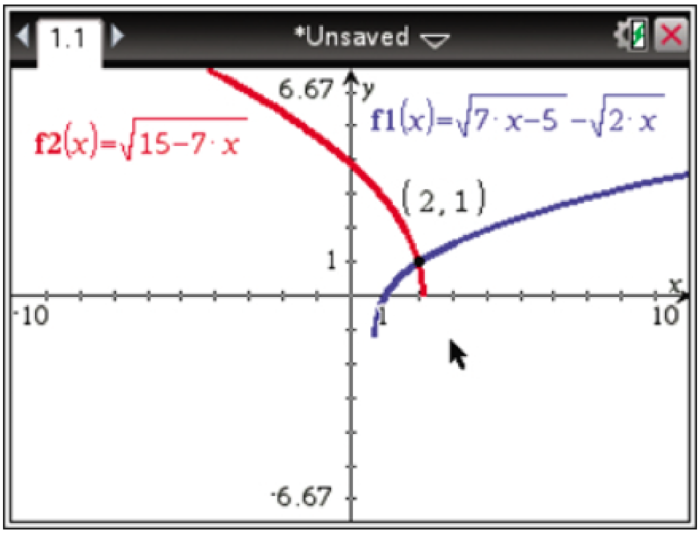
TI: Sketch the graphs of $\boldsymbol{f1}=\sqrt{\boldsymbol{7x-5}}-\sqrt{\boldsymbol{2x}}$

and $\boldsymbol{f2}=\sqrt{\boldsymbol{15-7x}}$

Press **Menu** $\rightarrow$ **6: Analyze**

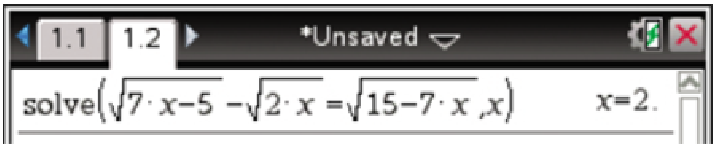
Graph $\rightarrow$ **4: Intersection**

CP: Sketch the graphs of $y1 = \sqrt{7x-5} - \sqrt{2x}$ and $y2 = \sqrt{15-7x}$ Tap **Analysis** $\rightarrow$**G-Solve** $\rightarrow$**Intersect**



Alternatively, type

solve $(\sqrt{7x-5} - \sqrt{2x} = \sqrt{15-7x}, x)$ in a Calculator/Main page.



9 a $n + 25$ is a perfect square implies

$$n + 25 = b^2$$
$$\therefore \quad n = b^2 - 25$$
$$= (b-5)(b+5)$$
$$\text{Let } a = b - 5$$
$$\text{then } b + 5 = a + 10$$
$$\therefore \quad n = a(a+10)$$

b

$$\text{Note:} \quad 0 < a(a+10) < 50$$
$$\therefore \quad a(a+10) - 50 < 0 \quad \ldots \boxed{1}$$
$$\text{and} \quad a(a+10) > 0 \quad \ldots \boxed{2}$$
$$\text{From } \boxed{1} \quad a^2 + 10a + 25 - 75 < 0$$
$$\therefore (a+5)^2 - (5\sqrt{3})^2 < 0$$
$$\therefore (a + 5 - 5\sqrt{3})(a + 5 + 5\sqrt{3}) < 0$$
$$\therefore a < -5 + 5\sqrt{3} \text{ and } a > -5 - 5\sqrt{3}$$

From $\boxed{2}$, $a < -10$ or $a > 0$

$\therefore \quad a = 3 \text{ or } 2 \text{ or } 1 \text{ or } -13 \text{ or } -12 \text{ or } -11$

Consider $10p + q = a^2 + 10a$.

$a = 1,\ p = 1,\ q = 1$
$a = 2,\ p = 2,\ q = 4$
$a = 3,\ p = 3,\ q = 9$
$a = -11,\ p = 1,\ q = 1$
$a = -12,\ p = 2,\ q = 4$
$a = -13,\ p = 3,\ q = 9$

Hence $q = p^2$.

c From the above, $n = 11$ or 24 or 39.

10a $\therefore \quad P = mgh$ for a constant $g \in R \setminus \{0\} P = 5gh$

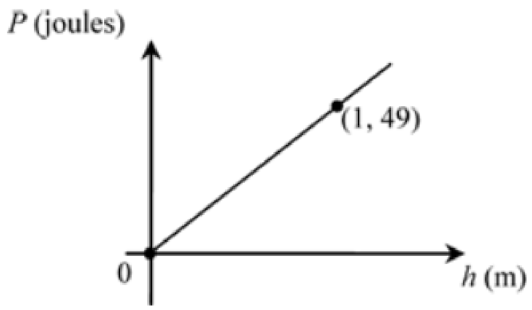
When $m = 5,\ P = 5gh$

$$\therefore \quad g = \frac{P}{5h}$$

i When $P = 980,\ h = 20,$

$$g = \frac{980}{5 \times 20} = 9.8$$

ii



iii When $h = 23.2,$

$m = 7$

b i Let $P_1 = 9.8mh,$

$$\therefore \quad P_2 = 9.8m \times (2h) = 19.6mh = 2P_1$$

$$\text{Percentage change in potential energy} = \frac{P_2 - P_1}{P_1} \times 100 = \frac{2P_1 - P_1}{P_1} \times 100 = 100$$

The potential energy has increased by 100%.

ii Let $P_1 = 9.8mh$

$$\therefore \quad P_2 = 9.8 \times 2m \times \frac{1}{4}h = 4.9mh = \frac{1}{2}P_1$$

$$\text{Percentage change in potential energy} = \frac{P_2 - P_1}{P_1} \times 100 = \frac{\frac{1}{2}P_1 - P_1}{P_1} \times 100 = -50$$

The potential energy has decreased by 50%.

c i When $h = 10,$

$$V = \sqrt{19.6 \times 10} = 14$$

ii When $h = 90,$

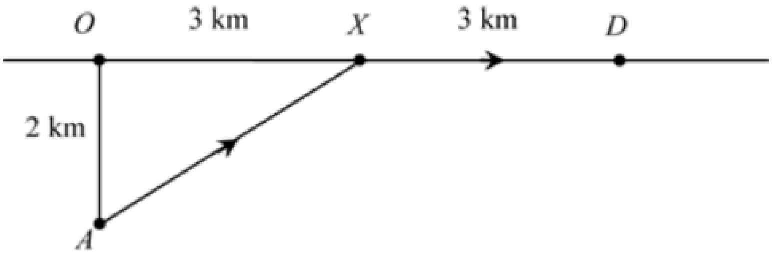
$$V = \sqrt{19.6 \times 90} = 42$$

d Let $V_1 = \sqrt{19.6h_1}$

$$\begin{aligned}\therefore V_2 &= 2V_1\\ &= 2\sqrt{19.6h_1}\\ &= \sqrt{19.6 \times 4h_1}\\ &= \sqrt{19.6h_2} \text{ where } h_2 = 4h_1\end{aligned}$$

The height must be increased by a factor of 4.

11a

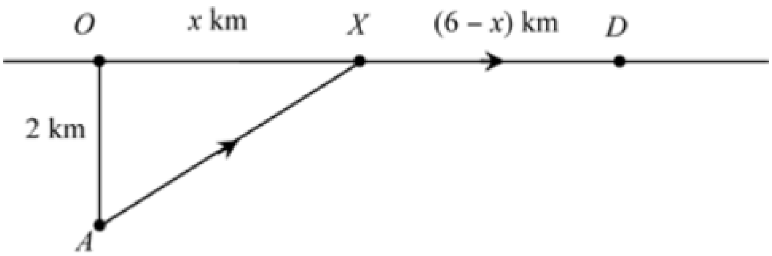


From the diagram,

$$\begin{aligned}AX &= \sqrt{2^2 + 3^2}\\ &= \sqrt{4+9}\\ &= \sqrt{13}\\ \text{Distance travelled} &= \text{speed} \times \text{time}\\ \text{time} &= \frac{\text{distance}}{\text{speed}}\\ \therefore \quad \text{Time taken for } AX &= \frac{\sqrt{13}}{3}\\ \text{Time taken for } XD &= \frac{3}{8}\\ \text{Total time taken } &= \frac{\sqrt{13}}{3} + \frac{3}{8}\\ &= 1.57685\ldots\\ 1.576\,85\ldots \text{ hours} &= 1 \text{ hour and } 0.576\,85\ldots \times 60 \text{ minutes}\\ &= 1 \text{ hour } 34.611\,02\ldots \text{ minutes}\end{aligned}$$

The time taken was 1 hour 35 minutes, correct to the nearest minute.

b



From the diagram, $AX = \sqrt{2^2 + x^2}$

$$= \sqrt{x^2 + 4}$$

Off-road he walks at 3 km/h

$$\therefore \quad \text{Time taken for } AX = \frac{\sqrt{x^2+4}}{3}$$

On-road he walks at 8Km/h for a distance of $(6 - x)$ km

$$\therefore \quad \text{Time taken for } XD = \frac{6-x}{8}$$

$$\text{Total time taken} = \frac{\sqrt{x^2+4}}{3} + \frac{6-x}{8} = \frac{3}{2}$$

$$\therefore \quad 8\sqrt{x^2+4} + 3(6-x) = 36$$

$$\therefore \quad 8\sqrt{x^2+4}+18-3x=36$$
$$\therefore \quad 8\sqrt{x^2+4}=3x+18$$
$$\therefore \quad (8\sqrt{x^2+4})^2=(3x+18)^2$$
$$\therefore \quad 64(x^2+4)=9x^2+108x+324$$
$$\therefore \quad 64x^2+256=9x^2+108x+324$$
$$\therefore \quad 55x^2-108x-68=0$$
$$x=\frac{+108\pm\sqrt{(-108)^2-4\times55\times(-68)}}{2\times55}$$
$$=-0.501\,53\ldots,2.465\,16\ldots$$
$$\text{but } x>0, \quad \therefore \quad x=2.465\,16\ldots$$

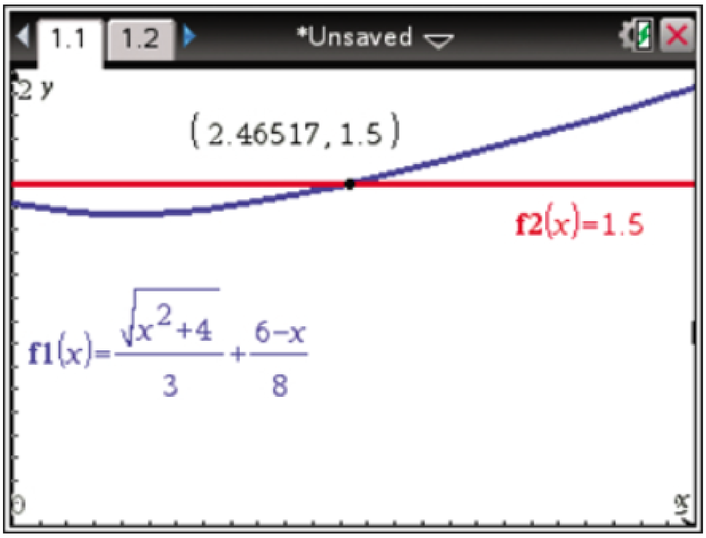
If the total time taken was $1\frac{1}{2}$ hours, OX is 2.5 km correct to one decimal place.

CAS calculator techniques for Question 19

Sketch the graphs of $\boldsymbol{f1(x)=\frac{\sqrt{x^2+4}}{3}+\frac{6-x}{8}}$ and $\boldsymbol{f2(x)=1.5}$

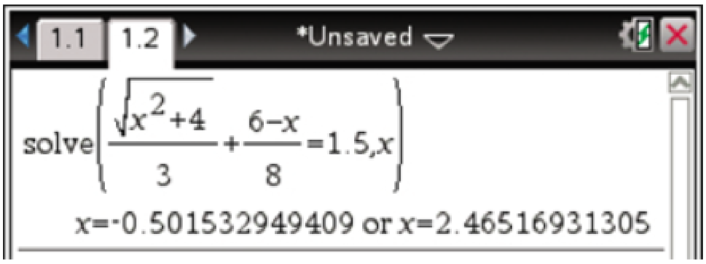
T1: Press **Menu** → **6**: **Analyze Graph** → **4**: **Intersection**

CP: Tap **Analysis** →**G-Solve** →**Intersect**



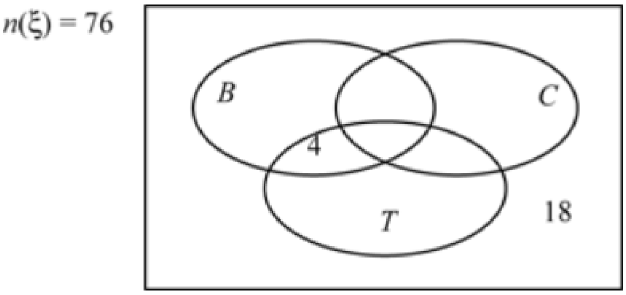
Alternatively, type

$\mathbf{solve}\left(\frac{\sqrt{x^2+4}}{3}+\frac{6-x}{8}=1.5,x\right)$ and interpret answers recalling $x>0$.



12a $|B'\cap C'\cap T|=|C\cap T|$
$|B\cap C'\cap T'|=3|B'\cap C\cap T'|$
$|B\cap C'\cap T|=4$

b



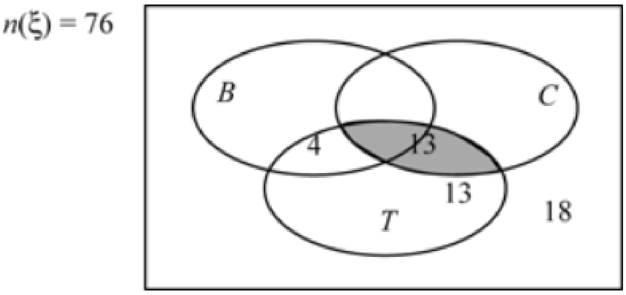
$$|C \cap T| + |B' \cap C' \cap T| + |B \cap C' \cap T| = |T|$$

$$\therefore \quad 2|C \cap T| + 4 = 30 \text{ as } |C \cap T| = |B' \cap C' \cap T|$$

$$\therefore \quad |C \cap T| = \frac{30 - 4}{2}$$

$$= 13$$

$$\therefore \quad |B' \cap C' \cap T| = 13$$



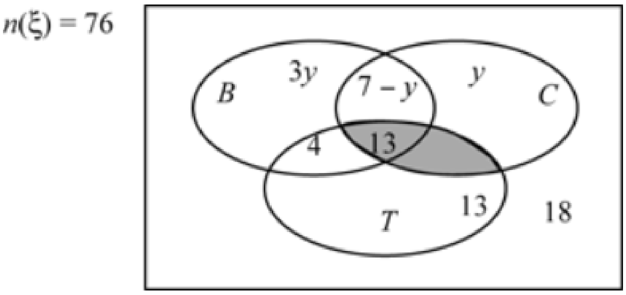
Let $|B' \cap C \cap T| = y$

$$|B \cap C' \cap T'| = 3y$$

$$|C| = |B' \cap C \cap T'| + |C \cap T| + |B \cap C \cap T'|$$

$$\therefore \quad 20 = y + 13 + |B \cap C \cap T'|$$

$$\therefore \quad |B \cap C \cap T'| = 7 - y$$



Now $3y + (7 - y) + 4 + 13 + 13 + y + 18 = 76$

$$\therefore \quad 3y + 55 = 76$$

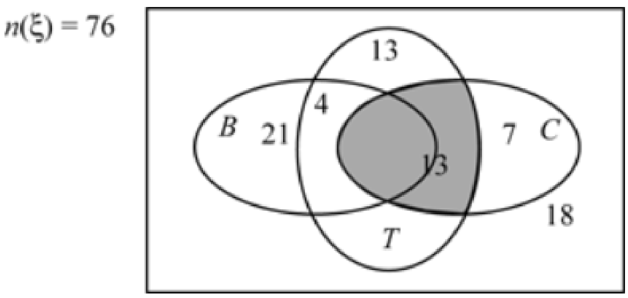
$$\therefore \quad 3y = 21$$

$$\therefore \quad y = 7$$

$$|B' \cap C \cap T'| = 7$$

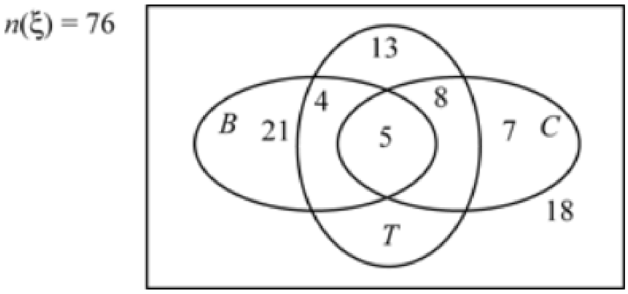
$$|B \cap C' \cap T'| = 21$$

$$|B \cap C \cap T'| = 0$$



$$
\begin{aligned}
|B \cap C \cap T| &= |B| - |B \cap C' \cap T'| - |B \cap C' \cap T| \\
&= 30 - 21 - 4 \\
&= 5
\end{aligned}
$$

$\therefore \quad |B' \cap C \cap T| = 13 - 5 = 8$



c **i** $|B \cap C \cap T| = 5$

ii $|B \cap C \cap T'| = 0$