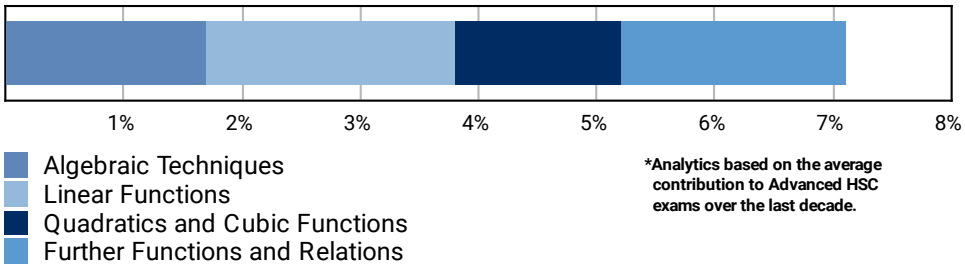
ADV: Functions (Adv), F1 Working with Functions (Adv)

Linear Functions (Y11)

Teacher: Troy McMurrich

Exam Equivalent Time: 90 minutes *(based on HSC allocation of 1.5 minutes approx. per mark)*

F1 Working With Functions



***Analytics based on the average contribution to Advanced HSC exams over the last decade.**

HISTORICAL CONTRIBUTION

- *F1 Working with Functions* is a Year 11 topic whose content represents the lowest of low hanging fruit in the new *Advanced* course.
- *F1 Working with Functions* includes new and a significant re-categorisation of old syllabus content. Any insights from past contributions in this topic area are unavoidably limited. However, with the information available, our analysis has it accounting for ~7.1%.
- We have split the topic into 5 categories for analysis purposes: *1-Algebraic Techniques, 2-Linear Functions, 3-Quadratics and Cubic Functions, 4-Composite Functions and 5-Further Functions and Relations.*
- This analysis looks at *Linear Functions (2.1%).*

HSC ANALYSIS - What to expect and common pitfalls

- *Linear Functions* will primarily look at analysing and modelling linear relationships, with a significant shift away from the old course *Plane Geometry* content.
- This area represents common Adv/Std2 content and the 2020 HSC exams included a 4-mark common question (*2020 Adv 11*).
- Modelling and analysis of linear equations looks at numerous Std2 past HSC questions which proved challenging, including breakeven analysis.
- Although co-ordinate geometry content is diminished, some important areas remain examinable in this area and should be reviewed.
- NESA's HSC sample exam included a challenging simultaneous equation question. Review *F1 EQ-Bank 12* to cover this area.

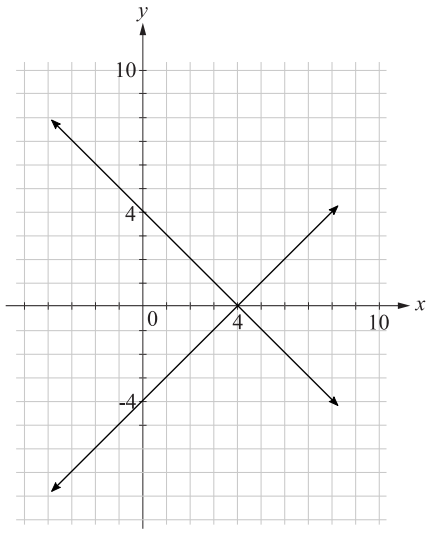
Questions

1. Algebra, STD2 A4 SM-Bank 6 MC

A computer application was used to draw the graphs of the equations

$x - y = 4$ and $x + y = 4$

Part of the screen is shown.



What is the solution when the equations are solved simultaneously?

A. $x = 4, y = 4$

B. $x = 4, y = 0$

C. $x = 0, y = 4$

D. $x = 0, y = -4$

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2. Functions, 2ADV F1 2015 HSC 2 MC

What is the slope of the line with equation $2x - 4y + 3 = 0$?

(A) -2

(B) $-\frac{1}{2}$

(C) $\frac{1}{2}$

(D) 2

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3. Functions, 2ADV F1 2017 HSC 1 MC

What is the gradient of the line $2x + 3y + 4 = 0$?

(A) $-\frac{2}{3}$

(B) $\frac{2}{3}$

(C) $-\frac{3}{2}$

(D) $\frac{3}{2}$

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4. Functions, 2ADV F1 2018 HSC 3 MC

What is the x-intercept of the line $x + 3y + 6 = 0$?

(A) $(-6, 0)$

(B) $(6, 0)$

(C) $(0, -2)$

(D) $(0, 2)$

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5. Algebra, STD2 A2 2019 HSC 14 MC

Last Saturday, Luke had 165 followers on social media. Rhys had 537 followers. On average, Luke gains another 3 followers per day and Rhys loses 2 followers per day.

If x represents the number of days since last Saturday and y represents the number of followers, which pair of equations model this situation?

A. Luke: $y = 165x + 3$
Rhys: $y = 537x - 2$

B. Luke: $y = 165 + 3x$
Rhys: $y = 537 - 2x$

C. Luke: $y = 3x + 165$
Rhys: $y = 2x - 537$

D. Luke: $y = 3 + 165x$
Rhys: $y = 2 - 537x$

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6. Functions, 2ADV F1 2014 HSC 5 MC

Which equation represents the line perpendicular to $2x - 3y = 8$, passing through the point $(2, 0)$?

(A) $3x + 2y = 4$

(B) $3x + 2y = 6$

(C) $3x - 2y = -4$

(D) $3x - 2y = 6$

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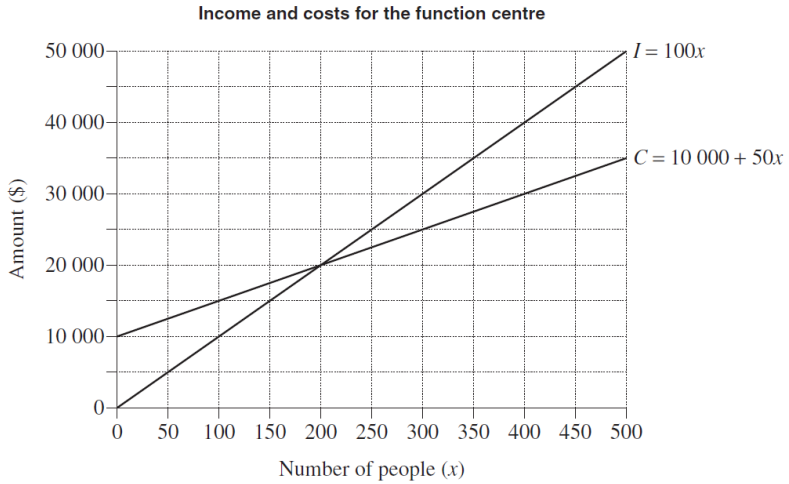
7. Algebra, STD2 A4 2011 HSC 20 MC

A function centre hosts events for up to 500 people. The cost C, in dollars, for the centre to host an event, where x people attend, is given by:

$$C = 10\,000 + 50x$$

The centre charges $100 per person. Its income I, in dollars, is given by:

$$I = 100x$$



How much greater is the income of the function centre when 500 people attend an event, than its income at the breakeven point?

(A) $15 000

(B) $20 000

(C) $30 000

(D) $40 000

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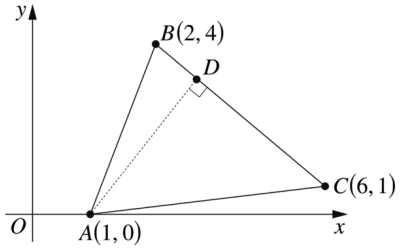
8. Functions, 2ADV F1 2016 HSC 12a

The diagram shows points $A(1, 0), B(2, 4)$ and $C(6, 1)$. The point D lies on BC such that $AD \perp BC$.



NOT TO SCALE

i. Show that the equation of BC is $3x + 4y - 22 = 0$. *(2 marks)*

NB. Parts ii-iii are not in the new syllabus.

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9. Functions, 2ADV F1 2015 HSC 11a

Simplify $4x - (8 - 6x)$. *(1 mark)*

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10. Functions, 2ADV F1 SM-Bank 24

Ita publishes and sells calendars for $25 each. The cost of producing the calendars is $8 each plus a set up cost of $5950.

How many calendars does Ita need to sell to breakeven? *(2 marks)*

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11. Functions, 2ADV F1 2007 HSC 1f

Find the equation of the line that passes through the point $(-1, 3)$ and is perpendicular to $2x + y + 4 = 0$. *(2 marks)*

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12. Functions, 2ADV F1 2009 HSC 1a

Sketch the graph of $y - 2x = 3$, showing the intercepts on both axes. *(2 marks)*

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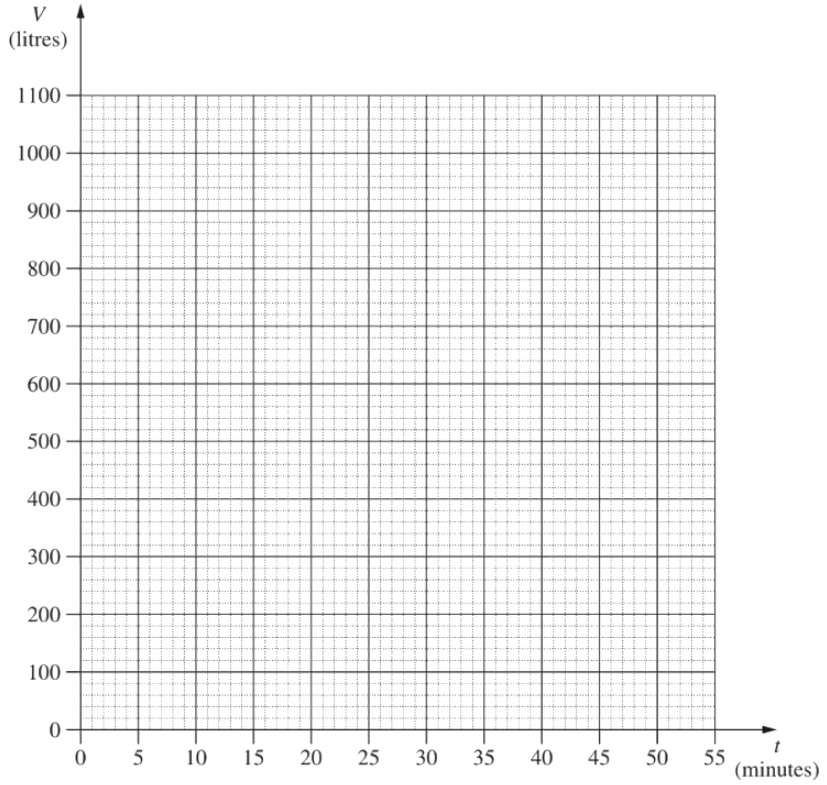
13. Functions, 2ADV F1 2020 HSC 11

There are two tanks on a property, Tank A and Tank B. Initially, Tank A holds 1000 litres of water and Tank B is empty.

a. Tank A begins to lose water at a constant rate of 20 litres per minute. The volume of water in Tank A is modelled by $V = 1000 - 20t$ where V is the volume in litres and t is the time in minutes from when the tank begins to lose water. *(1 mark)*

On the grid below, draw the graph of this model and label it as Tank A.



b. Tank B remains empty until $t = 15$ when water is added to it at a constant rate of 30 litres per minute.

By drawing a line on the grid (above), or otherwise, find the value of t when the two tanks contain the same volume of water. *(2 marks)*

c. Using the graphs drawn, or otherwise, find the value of t (where $t > 0$) when the total volume of water in the two tanks is 1000 litres. *(1 mark)*

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14. Functions, 2ADV F1 SM-Bank 25

Damon owns a swim school and purchased a new pool pump for $3250.

He writes down the value of the pool pump by 8% of the original price each year.

i. Construct a function to represent the value of the pool pump after t years. ***(1 mark)***

ii. Draw the graph of the function and state its domain and range. ***(2 marks)***

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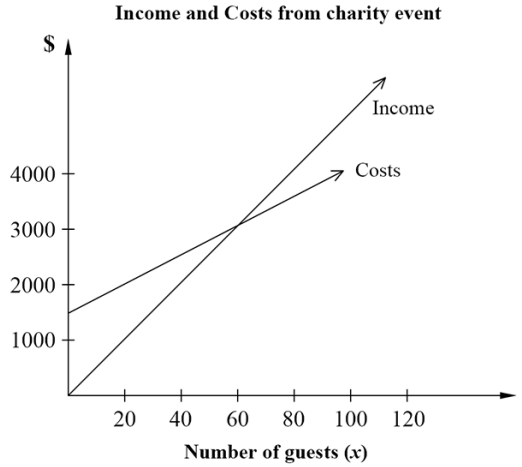
15. Functions, STD2 A4 SM-Bank 27

Fiona and John are planning to hold a fund-raising event for cancer research. They can hire a function room for $650 and a band for $850. Drinks will cost them $25 per person.

i. Write a formula for the cost ($C) of holding the charity event for x people. ***(1 mark)***

ii. The graph below shows the planned income and costs if they charge $50 per ticket. Estimate the number of guests they need to break even. ***(1 mark)***



iii. How much profit will Fiona and John make if 80 people attend their event? ***(1 mark)***

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16. Functions, 2ADV F1 EQ-Bank 12

Two archers play a game where each can aim for a large target or a small target.

If an arrow hits the large target it scores L points, and if it hits the small target, it scores S points.

The results of a game are shown in the table below.

Archer	Number of large target hits	Number of small target hits	Total Score
1	5	8	71
2	12	5	71

By forming a pair of simultaneous equations, or otherwise, find the value of L and S. ***(3 marks)***

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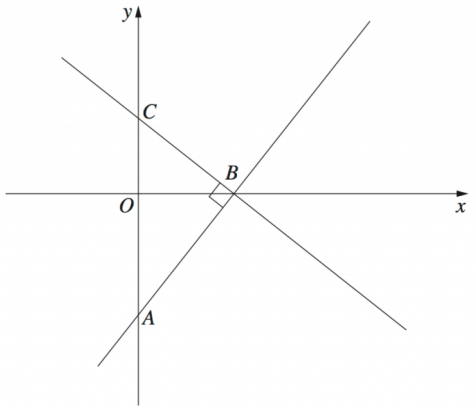
17. Functions, 2ADV F1 2009 HSC 5a

In the diagram, the points A and C lie on the y-axis and the point B lies on the x-axis. The line AB has equation $y = \sqrt{3}x - 3$. The line BC is perpendicular to AB.



i. Find the equation of the line BC. ***(2 marks)***

ii. Find the area of the triangle ABC. ***(2 marks)***

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18. Algebra, STD2 A2 2007 HSC 27b

A clubhouse uses four long-life light globes for five hours every night of the year. The purchase price of each light globe is \$6.00 and they each cost $\$d$ per hour to run.

i. Write an equation for the total cost ($\$c$) of purchasing and running these four light globes for one year in terms of d. ***(2 marks)***

ii. Find the value of d (correct to three decimal places) if the total cost of running these four light globes for one year is \$250. ***(1 mark)***

iii. If the use of the light globes increases to ten hours per night every night of the year, does the total cost double? Justify your answer with appropriate calculations. ***(1 mark)***

iv. The manufacturer's specifications state that the expected life of the light globes is normally distributed with a standard deviation of 170 hours.

What is the mean life, in hours, of these light globes if 97.5% will last up to 5000 hours? ***(1 mark)***

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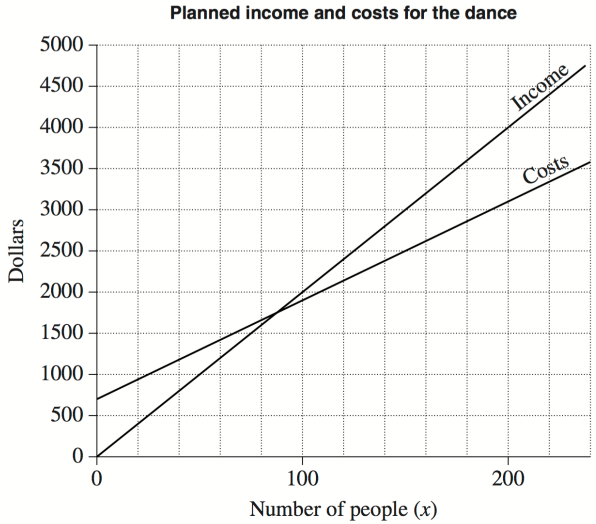
19. Algebra, STD2 A4 2005 HSC 28b

Sue and Mikey are planning a fund-raising dance. They can hire a hall for \$400 and a band for \$300. Refreshments will cost them \$12 per person.

i. Write a formula for the cost (\$C) of running the dance for x people. ***(1 mark)***

The graph shows planned income and costs when the ticket price is \$20



ii. Estimate the minimum number of people needed at the dance to cover the costs. ***(1 mark)***

iii. How much profit will be made if 150 people attend the dance? ***(1 mark)***

Sue and Mikey plan to sell 200 tickets. They want to make a profit of \$1500.

iv. What should be the price of a ticket, assuming all 200 tickets will be sold? ***(3 marks)***

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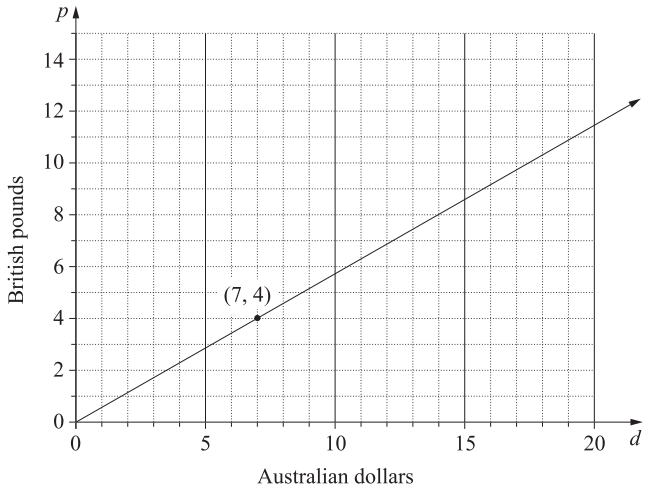
20. Algebra, STD2 A2 2019 HSC 34

The relationship between British pounds (p) and Australian dollars (d) on a particular day is shown in the graph.



a. Write the direct variation equation relating British pounds to Australian dollars in the form $p = md$. Leave m as a fraction. ***(1 mark)***

b. The relationship between Japanese yen (y) and Australian dollars (d) on the same day is given by the equation $y = 76d$.

Convert 93 100 Japanese yen to British pounds. ***(2 marks)***

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21. Algebra, STD2 A2 2015 HSC 27c

Ariana's parents have given her an interest-free loan of \$4800 to buy a car. She will pay them back by paying $\$x$ immediately and $\$y$ every month until she has repaid the loan in full.

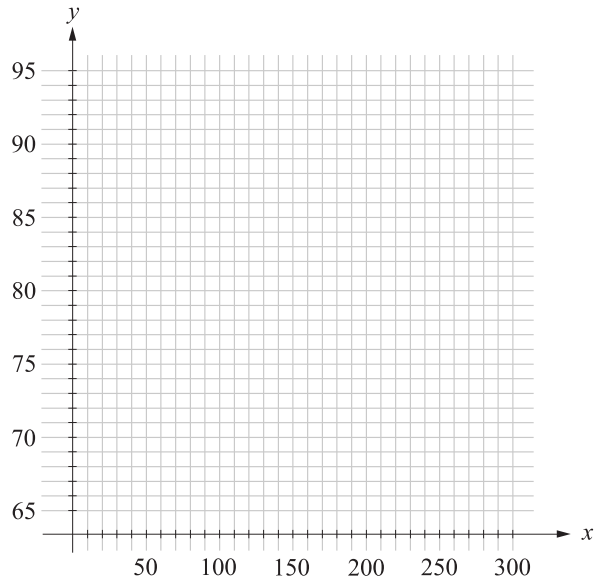
After 18 months Ariana has paid back \$1510, and after 36 months she has paid back \$2770.

This information can be represented by the following equations.

$$x + 18y = 1510$$

$$x + 36y = 2770$$

i. Graph these equations below and use to solve simultaneously for the values of x and y. ***(2 marks)***



ii. How many months will it take Ariana to repay the loan in full? ***(2 marks)***

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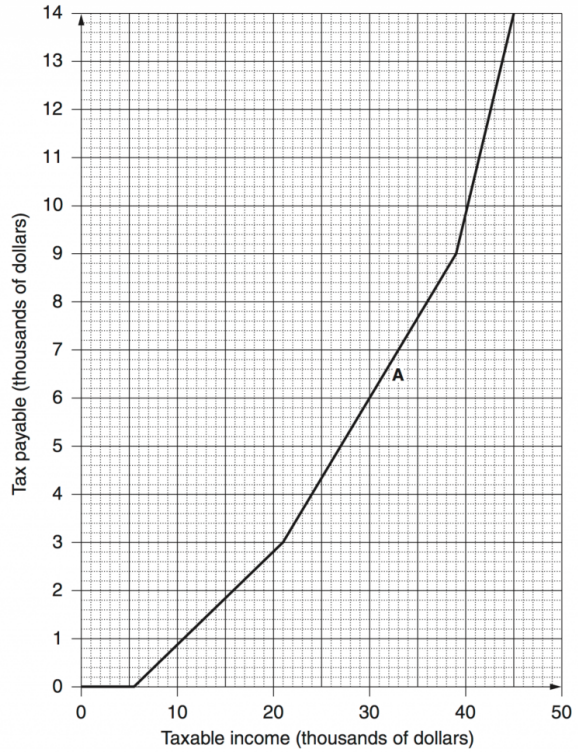
22. Algebra, STD2 A2 2010 HSC 27c

The graph shows tax payable against taxable income, in thousands of dollars.



i. Use the graph to find the tax payable on a taxable income of \$21 000. ***(1 mark)***

ii. Use suitable points from the graph to show that the gradient of the section of the graph marked A is $\frac{1}{3}$. ***(1 mark)***

iii. How much of each dollar earned between \$21 000 and \$39 000 is payable in tax? ***(1 mark)***

iv. Write an equation that could be used to calculate the tax payable, T, in terms of the taxable income, I, for taxable incomes between \$21 000 and \$39 000. ***(2 marks)***

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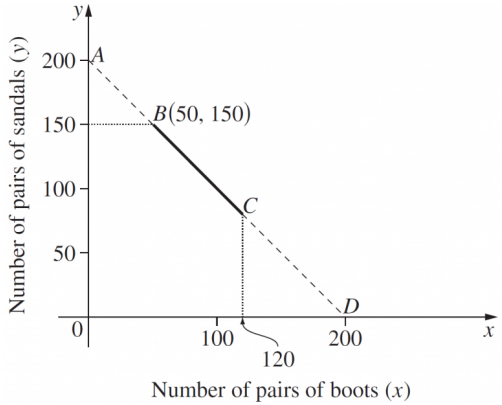
23. Algebra, STD2 A2 2009 HSC 24d

A factory makes boots and sandals. In any week

- the total number of pairs of boots and sandals that are made is 200
- the maximum number of pairs of boots made is 120
- the maximum number of pairs of sandals made is 150.

The factory manager has drawn a graph to show the numbers of pairs of boots (x) and sandals (y) that can be made.



i. Find the equation of the line AD. *(1 mark)*

ii. Explain why this line is only relevant between B and C for this factory. *(1 mark)*

iii. The profit per week, $\$P$, can be found by using the equation $P = 24x + 15y$. Compare the profits at B and C. *(2 marks)*

Worked Solutions

1. Algebra, STD2 A4 SM-Bank 6 MC

Solution occurs at the intersection of the two lines.

$\Rightarrow B$

2. Functions, 2ADV F1 2015 HSC 2 MC

$$2x - 4y + 3 = 0$$
$$4y = 2x + 3$$
$$y = \frac{1}{2}x + \frac{3}{4}$$

$\therefore$ Slope $= \frac{1}{2}$

$\Rightarrow C$

3. Functions, 2ADV F1 2017 HSC 1 MC

$$2x + 3y + 4 = 0$$
$$3y = -2x - 4$$
$$y = -\frac{2}{3}x - \frac{4}{3}$$

$\therefore$ Gradient $= -\frac{2}{3}$

$\Rightarrow A$

4. Functions, 2ADV F1 2018 HSC 3 MC

x-intercept occurs when $y = 0$

$$x + 0 + 6 = 0$$
$$x = -6$$

$\therefore x$-intercept is $(-6, 0)$

$\Rightarrow A$

5. Algebra, STD2 A2 2019 HSC 14 MC

Luke starts with 165 and adds 3 per day:

$$y = 165 + 3x$$

Rhys starts with 537 and loses 2 per day:

$$y = 537 - 2x$$

$$\Rightarrow B$$

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6. Functions, 2ADV F1 2014 HSC 5 MC

$$2x - 3y = 8$$

$$3y = 2x - 8$$

$$y = \frac{2}{3}x - \frac{8}{3}$$

$$m = \frac{2}{3}$$

$$\therefore\ m_{\text{perp}} = -\frac{3}{2} \quad (m_1 m_2 = \text{-1 for } \perp \text{ lines})$$

Equation of line $m = -\frac{3}{2}$ **through** $(2, 0)$

$$y - y_1 = m(x - x_1)$$

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

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

$$2y = -3x + 6$$

$$3x + 2y = 6$$

$$\Rightarrow B$$

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7. Algebra, STD2 A4 2011 HSC 20 MC

When $x = 500$, $I = 100 \times 500 = \$50\,000$

Breakeven when $x = 200$ **(from graph)**

When $x = 200$, $I = 100 \times 200 = \$20\,000$

$$\text{Difference} = 50\,000 - 20\,000$$

$$= \$30\,000$$

$$\Rightarrow C$$

♦ *Mean mark 50%*
COMMENT: Students can read the income levels directly off the graph to save time and then check with the equations given.

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8. Functions, 2ADV F1 2016 HSC 12a

a.i. $B(2, 4)$, $C(6, 1)$

$$m_{BC} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - 4}{6 - 2} = -\frac{3}{4}$$

Equation of BC, $m = -\frac{3}{4}$ **through** $(2, 4)$,

$$y - y_1 = m(x - x_1)$$

$$y - 4 = -\frac{3}{4}(x - 2)$$

$$4y - 16 = -3x + 6$$

$$3x + 4y - 22 = 0 \ldots \text{as required.}$$

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9. Functions, 2ADV F1 2015 HSC 11a

$$4x - (8 - 6x)$$

$$= 4x - 8 + 6x$$

$$= 10x - 8$$

$$= 2(5x - 4)$$

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10. Functions, 2ADV F1 SM-Bank 24

Let $x =$ number of calendars sold

Cost $= 5950 + 8x$

Sales revenue $= 25x$

Breakeven occurs when:

$$25x = 5950 + 8x$$
$$17x = 5950$$
$$\therefore x = 350$$

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11. Functions, 2ADV F1 2007 HSC 1f

$$2x + y + 4 = 0$$
$$y = -2x - 4$$
$$\Rightarrow \text{Gradient} = -2$$

$\therefore$ Perpendicular of gradient $= \frac{1}{2} \quad (m_1 m_2 = -1)$

Equation of line $m = \frac{1}{2}$, through $(-1, 3)$

$$y - y_1 = m(x - x_1)$$
$$y - 3 = \frac{1}{2}(x + 1)$$
$$y = \frac{1}{2}x + \frac{7}{2}$$
$$2y = x + 7$$
$$\therefore x - 2y + 7 = 0$$

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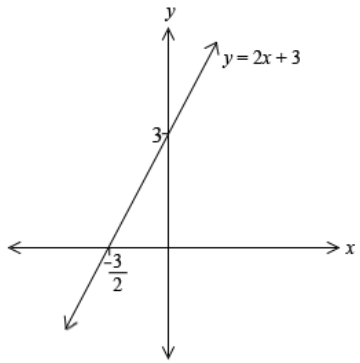
12. Functions, 2ADV F1 2009 HSC 1a

$$y - 2x = 3 \Rightarrow y = 2x + 3$$



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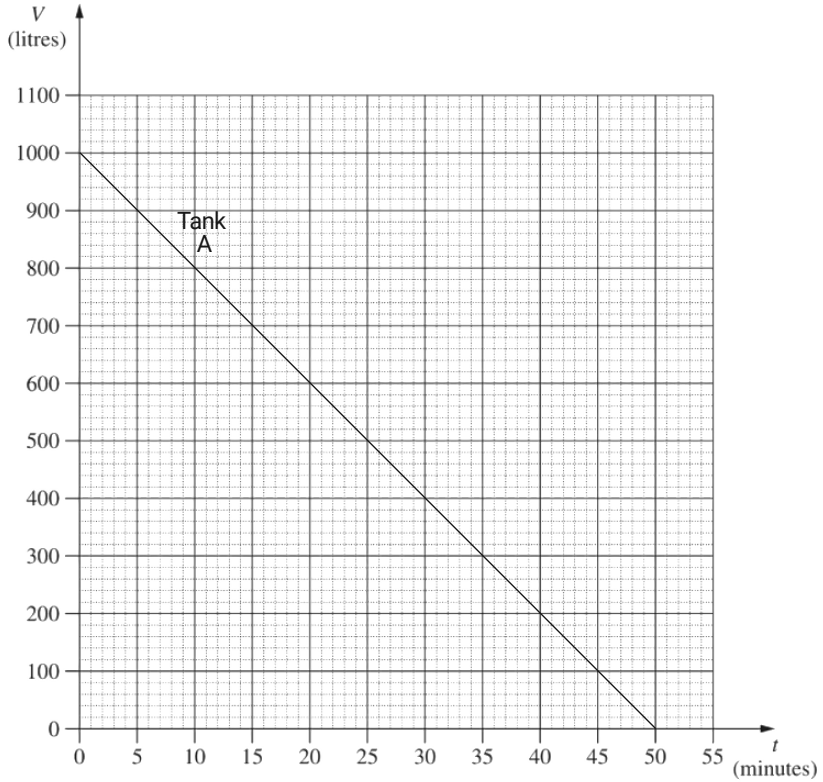
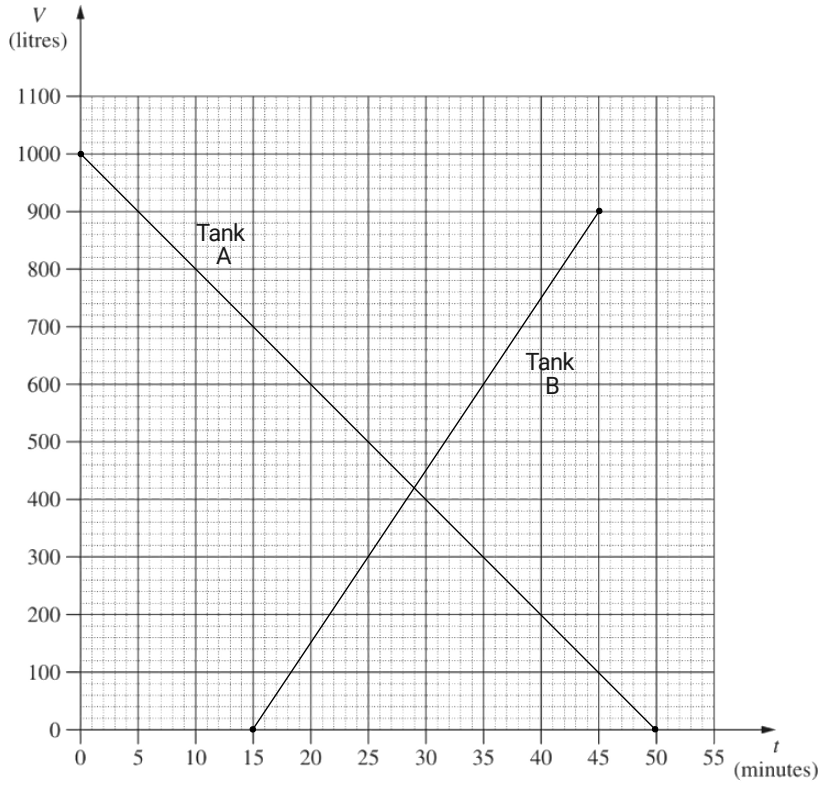
13. Functions, 2ADV F1 2020 HSC 11

a. Tank A will pass trough $(0, 1000)$ and $(50, 0)$



b. Tank B will pass through $(15, 0)$ and $(45, 900)$



By inspection, the two graphs intersect at $t = 29$ minutes

c. Strategy 1

By inspection of the graph, consider $t = 45$

Tank A $= 100$ L, Tank B $= 900$ L

$\therefore$ Total volume $= 1000$ L when t $= 45$

Strategy 2

$$\text{Total Volume} = \text{Tank A} + \text{Tank B}$$

$$1000 = 1000 - 20t + (t - 15) \times 30$$

$$1000 = 1000 - 20t + 30t - 450$$

$$10t = 450$$

$$t = 45 \text{ minutes}$$

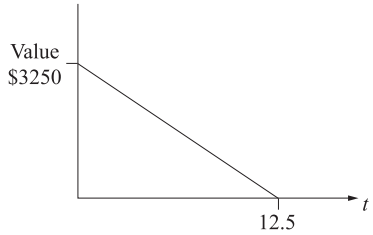
14. Functions, 2ADV F1 SM-Bank 25

i. $\text{Depreciation each year} = 8\% \times 3250$

$= \$260$

$\therefore \text{ Value} = 3250 - 260t$

ii.



Find t when value $= 0$

$3250 - 260t = 0$

$$t = \frac{3250}{260}$$

$= 12.5 \text{ years}$

Domain $\{t : 0 \leq t \leq 12.5\}$

Range $\{y : 0 \leq y \leq 3250\}$

15. Functions, STD2 A4 SM-Bank 27

i. $\text{Fixed Costs} = 650 + 850$

$= \$1500$

$\text{Variable Costs} = \$25x$

$\therefore \ \$C = 1500 + 25x$

ii. From the graph

Costs = Income when $x = 60$

(i.e. where graphs intersect)

iii. When $x = 80$:

$\text{Income} = 80 \times 50$

$= \$4000$

$\$C = 1500 + 25 \times 80$

$= \$3500$

$\therefore \text{ Profit} = 4000 - 3500$

$= \$500$

16. Functions, 2ADV F1 EQ-Bank 12

$5L + 8S = 71 \ \ldots (1)$

$12L + 5S = 71 \ \ldots (2)$

Multiply $(1) \times 5$

$25L + 40S = 355 \ \ldots (3)$

Multiply $(2) \times 8$

$96L + 40S = 568 \ \ldots (4)$

Subtract $(4) - (3)$

$71L = 213$

$\therefore L = 3$

Substitute $L = 3$ into (1)

$8S = 56$

$\therefore S = 7$

17. Functions, 2ADV F1 2009 HSC 5a

i. Gradient of $AB = \sqrt{3}$

$\therefore m_{BC} = -\frac{1}{\sqrt{3}} \ (BC \perp AB)$

Finding B,

$0 = \sqrt{3}x - 3$

$\sqrt{3}x = 3$

$x = \frac{3}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

$= \sqrt{3}$

$\therefore B(\sqrt{3}, 0)$

Equation of BC has $m = -\frac{1}{\sqrt{3}}$ through $(\sqrt{3}, 0)$

$y - y_1 = m(x - x_1)$

$y - 0 = -\frac{1}{\sqrt{3}}(x - \sqrt{3})$

$y = -\frac{1}{\sqrt{3}}x + 1$

ii. AB cuts y-axis when $x = 0, \ y = -3$

$\Rightarrow A(0, -3)$

BC cuts y-axis when $x = 0, \ y = 1$

$\Rightarrow C(0, 1)$

$\therefore AC = 4$

$OB = \sqrt{3}$

Area $\Delta ABC = \frac{1}{2} \times AC \times OB$

$= \frac{1}{2} \times 4 \times \sqrt{3}$

$= 2\sqrt{3} \text{ u}^2$

18. Algebra, STD2 A2 2007 HSC 27b

i. Purchase price $= 4 \times 6 = \$24$

$$\begin{aligned}\text{Running cost} &= \#\text{ Hours} \times \text{cost per hour} \\ &= 4 \times 5 \times 365 \times d \\ &= 7300d\end{aligned}$$

$$\therefore \$c = 24 + 7300d$$

ii. Given $\$c = \$250$

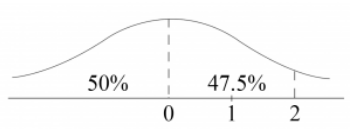
$$\begin{aligned}250 &= 24 + 7300d \\ 7300d &= 226 \\ d &= \frac{226}{7300} \\ &= 0.03095... \\ &= 0.031 \text{ \$/hr (3 d.p.)}\end{aligned}$$

iii. If d doubles to 0.062 \$/hr

$$\begin{aligned}\$c &= 24 + 7300 \times 0.062 \\ &= \$476.60\end{aligned}$$

Since \$476.60 is less than $2 \times \$250$ (\$500), the total cost increases to less than double the original cost.

iv. $\sigma = 170$



z-score of 5000 hours $= 2$

$$\begin{aligned}z &= \frac{x - \mu}{\sigma} \\ 2 &= \frac{5000 - \mu}{170} \\ 340 &= 5000 - \mu \\ \mu &= 4660\end{aligned}$$

$\therefore$ The mean life of these globes is 4660 hours.

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19. Algebra, STD2 A4 2005 HSC 28b

i. $\$C = 400 + 300 + (12 \times x)$

$$= 700 + 12x$$

ii. Using the graph intersection

Approximately 90 people are needed to cover the costs.

iii. If 150 people attend

$$\begin{aligned}\text{Income} &= 150 \times \$20 \\ &= \$3000 \\ \text{Costs} &= 700 + (12 \times 150) \\ &= \$2500\end{aligned}$$

$$\begin{aligned}\therefore \text{ Profit} &= 3000 - 2500 \\ &= \$500\end{aligned}$$

iv. Costs when $x = 200$:

$$\begin{aligned}C &= 700 + (12 \times 200) \\ &= \$3100\end{aligned}$$

Income required to make \$1500 profit

$$\begin{aligned}&= 3100 + 1500 \\ &= \$4600\end{aligned}$$

$$\begin{aligned}\therefore \text{ Price per ticket} &= \frac{4600}{200} \\ &= \$23\end{aligned}$$

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20. Algebra, STD2 A2 2019 HSC 34

a. $m = \dfrac{\text{rise}}{\text{run}} = \dfrac{4}{7}$

$p = \dfrac{4}{7}d$

♦ Mean mark 42%.

b. Yen to Australian dollars:

$$y = 76d$$
$$93\,100 = 76d$$
$$d = \frac{93\,100}{76}$$
$$= 1225$$

Aust dollars to pounds:

$$p = \frac{4}{7} \times 1225$$
$$= 700 \text{ pounds}$$

$\therefore$ 93 100 Yen = 700 pounds

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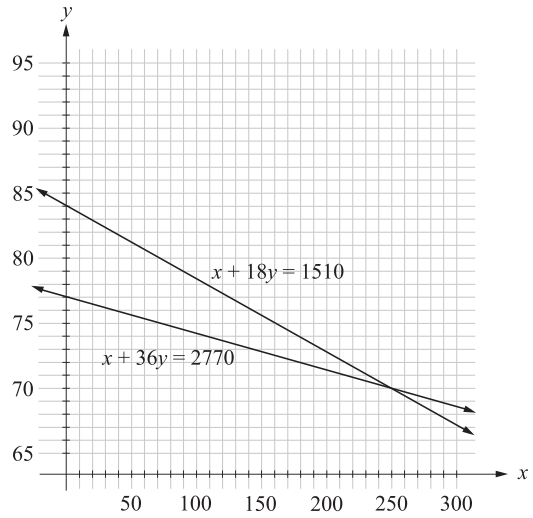
21. Algebra, STD2 A2 2015 HSC 27c

i.



$\therefore$ Solution is $x = 250,\ y = 70$

ii. Let A = the amount paid back after n months

$A = 250 + 70n$

Find n when $A = 4800$

$250 + 70n = 4800$

$70n = 4550$

$n = 65$

$\therefore$ It will take Ariana 65 months to repay the loan in full.

♦ Mean mark 44%.

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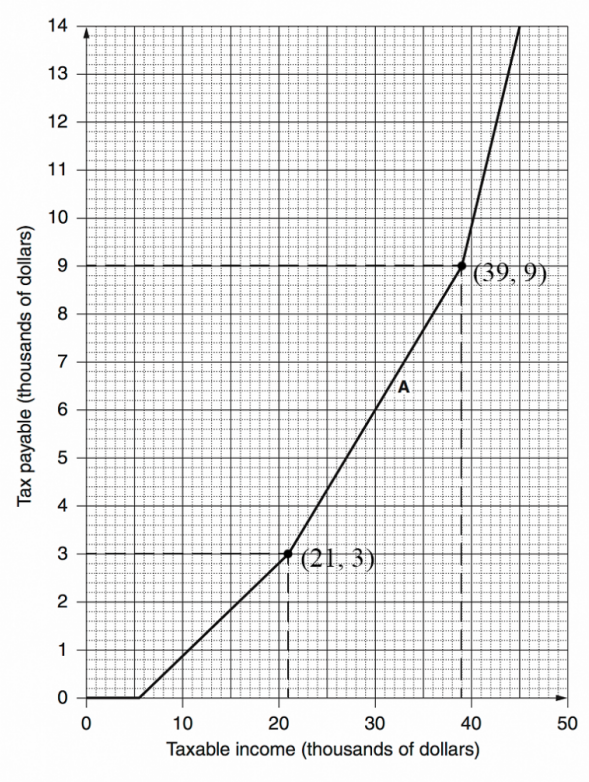
22. Algebra, STD2 A2 2010 HSC 27c

i.



$$\text{Income on \$21 000} = \$3000 \quad \text{(from graph)}$$

ii. Using the points $(21, 3)$ and $(39, 9)$

♦♦ *Mean mark 25%*

$$\begin{aligned}\text{Gradient at } A &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{9000 - 3000}{39\,000 - 21\,000} \\ &= \frac{6000}{18\,000} \\ &= \frac{1}{3} \quad \text{... as required}\end{aligned}$$

iii. The gradient represents the tax applicable to each dollar

$$\text{Tax} = \frac{1}{3} \text{ of each dollar earned}$$

♦♦♦ *Mean mark 12%!*
MARKER'S COMMENT: Interpreting gradients

$= 33\frac{1}{3}$ cents per dollar earned

is an examiner favourite, so make sure you are confident in this area.

iv. Tax payable up to \$21 000 $= \$3000$

Tax payable on income between \$21 000 and \$39 000

$= \frac{1}{3}(I - 21\,000)$

$\therefore$ Tax payable on $I = 3000 + \frac{1}{3}(I - 21\,000)$

$= 3000 + \frac{1}{3}I - 7000$

$= \frac{1}{3}I - 4000$

♦♦♦ *Mean mark 15%.*
STRATEGY: The earlier parts of this question direct students to the most efficient way to solve this question. Make sure earlier parts of a question are ***front and centre of your mind*** when devising strategy.

23. Algebra, STD2 A2 2009 HSC 24d

i. We are told the number of boots (x),

and shoes (y), made in any week $= 200$

$\Rightarrow$ Equation of AD is $x + y = 200$

♦♦♦ *Mean mark part (i) 14%.*
Using $y = mx + b$ is a less efficient but equally valid method, using $m = -1$ and $b = 200$ (y-intercept).

ii. Since the max amount of boots $= 120$

$\Rightarrow x$ cannot > 120

Since the max amount of sandals $= 150$

$\Rightarrow y$ cannot > 150

$\therefore$ The line AD is only possible between B and C.

♦ *Mean mark 49%*

iii. At B, $x = 50$, $y = 150$

$\Rightarrow \$P$ (at B) $= 24 \times 50 + 15 \times 150$

$= 1200 + 2250$

$= \$3450$

At C, $x = 120, y = 80$

$\Rightarrow \$P$ (at C) $= 24 \times 120 + 15 \times 80$

$= 2880 + 1200$

$= \$4080$

$\therefore$ The profits at C are \$630 more than at B.

♦ *Mean mark 40%.*