Thank you for subscribing to SmarterMaths Teacher Edition (Silver) in 2020.

The "2020 HSC Comprehensive Revision Series" provides around 12 hours of HSC revision questions for early starters. It has a weighting toward more difficult examples and is targeted at motivated students aiming for a Band 5 or 6 result. We recommend students ***attempt, carefully review and annotate*** this revision set in Term 3, and use it as the foundation of a concise and high quality revision resource.

As in previous years, our "Final Stretch HSC Revision Series", which is a shorter version of this revision set for late starters, will be available in early-September for the final weeks before the Standard 2 HSC exam.

Our analysis on each topic, the common question types, past areas of difficulty and recent HSC trends all combine to create this revision set that ensures students cover a wide cross-section of the key areas.

IMPORTANT: If students have been exposed to many of the questions in these worksheets during the year, we say great. Many top performing students attest to the benefits of doing quality questions 2-3 times before the HSC. The resulting confidence and speed through the exam creates a virtuous cycle for peak performance.

HSC Final Study – STD2 Algebra (estimated ~16% of exam)

Key Areas addressed by this worksheet

A1 Formulae and Equations

- harder formula *rearrange* questions of linear equations, including the poorly answered 2019 HSC 11 MC (note that rearranging non-linear equations is not examinable in the 2020 HSC exam);
- substituting given values into both linear and non-linear equations .. poorly answered examples are a focus;
- algebraic fractions – caused significant issues in 2018!
- "find the mistake" questions, historically poorly answered;
- medicine dosage formulae covered – omitted in 2019 after being tested in each of the previous 5 years;
- stopping distance calculations – sub-50% mean marks the last 2 times it was examined and omitted in the 2019 paper;
- BAC calculations (must review question type);
- *distance, speed and time equations (D=S×T)* have attracted tough multiple-choice questions in the past. *2011 Q21 MC* reviews the upper difficulty level of this area.

A2 Linear Relationships

- tested via multiple choice in 4 consecutive years between 2014-2017. This question type is well covered;
- most common question types reviewed, primarily identifying simple graphs and finding gradients;
- pay careful attention to avoid silly errors in this area - mean marks often sub-50%!
- *Applications of Linear Relationships* - currency conversion (sub-50% mean mark in 2019) and the regularly tested fuel consumption questions are reviewed;
- challenging linear modelling questions with significant mark allocations are reviewed.

A4 Types of Relationships

- *Simultaneous Equations and Applications* are a revision focus. The 2019 HSC profit and loss question was poorly answered and we review a similar financial example, along with other harder multiple choice;
- *Non-Linear: Exponentials/Quadratics* is important, due in large part to the chunky allocations it regularly receives when it does appear, often in cross-topic questions;
- revision of multiple-choice questions that require students to recognise non-linear graphs is covered - examined in 50% of papers;
- *Non-Linear: Inverse and Other Problems* is almost always poorly answered (2019's good results in this topic area is an outlier). We look specifically at the challenging example in *2018 (Q29c).*

STANDARD 2:
2020 HSC Comprehensive Revision Series - ALGEBRA

A1 Formulae and Equations (Y11)

A2 Linear Relationships (Y11)

A4 Types of Relationships (Y12)

Teacher: Smarter Maths

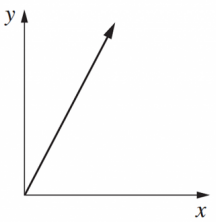
Exam Equivalent Time: 90 minutes *(based on HSC allocation of 1.5 minutes approx. per mark)*

Questions

1. Algebra, STD2 A4 2008 HSC 4 MC

Which graph best represents $y = 3^x$?

(A)



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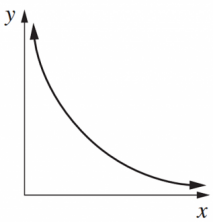

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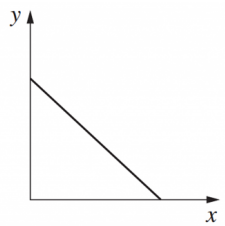

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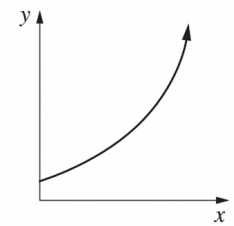
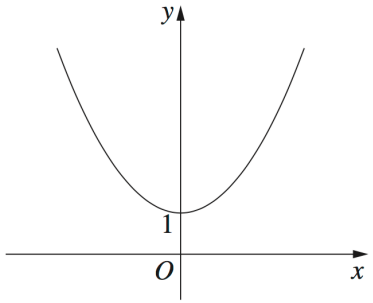


2. Algebra, STD2 A4 2014 HSC 3 MC

The diagram shows the graph of an equation.



Which of the following equations does the graph best represent?

(A) $y = \frac{3}{x} + 1$

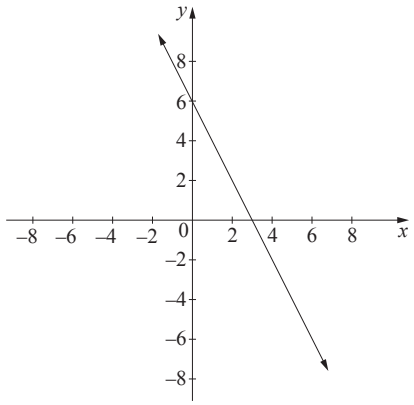
(B) $y = 3^x + 1$

(C) $y = 3x^2 + 1$

(D) $y = 3x^3 + 1$

3. Algebra, STD2 A4 2017 HSC 17 MC

The graph of the line with equation $y = 6 - 2x$ is shown.



When the graph of the line with equation $y = x + 3$ is also drawn on this number plane, what will be the point of intersection of the two lines?

A. $(0, 6)$

B. $(1, 4)$

C. $(2, 2)$

D. $(3, 0)$

---

4. Algebra, STD2 A2 2014 HSC 22 MC

Heather's car uses fuel at the rate of 6.6 L per 100 km for long-distance driving and 8.9 L per 100 km for short-distance driving.

She used the car to make a journey of 560 km, which included 65 km of short-distance driving.

Approximately how much fuel did Heather's car use on the journey?

(A) 37 L

(B) 38 L

(C) 48 L

(D) 50 L

---

5. Algebra, STD2 A1 2014 HSC 17 MC

A child who weighs 14 kg needs to be given 15 mg of paracetamol for every 2 kg of body weight.

Every 10 mL of a particular medicine contains 120 mg of paracetamol.

What is the correct dosage of this medicine for the child?

(A) 5.6 mL

(B) 8.75 mL

(C) 11.43 mL

(D) 17.5 mL

---

6. Algebra, STD2 A1 2010 HSC 7 MC

If $M = -9$, what is the value of $\dfrac{3M^2 + 5M}{6}$

(A) -250.5

(B) -48

(C) 33

(D) 235.5

---

7. Algebra, STD2 A1 2011 HSC 21 MC

A train departs from Town A at 3.00 pm to travel to Town B. Its average speed for the journey is 90 km/h, and it arrives at 5.00 pm. A second train departs from Town A at 3.10 pm and arrives at Town B at 4.30 pm.

What is the average speed of the second train?

(A) 135 km/h

(B) 150 km/h

(C) 216 km/h

(D) 240 km/h

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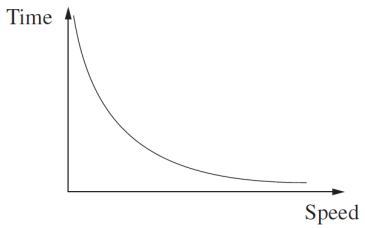
8. Algebra, STD2 A1 2009 HSC 16 MC

The time for a car to travel a certain distance varies inversely with its speed.

Which of the following graphs shows this relationship?

(A)



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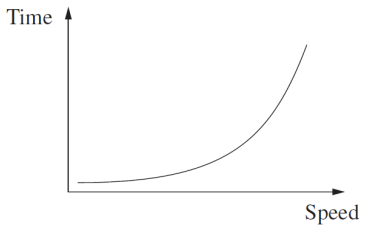

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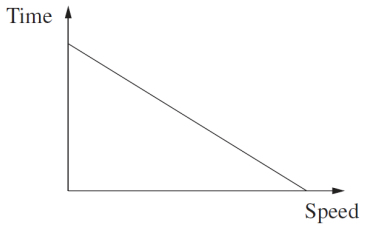

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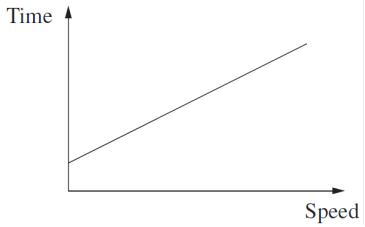

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9. Algebra, STD2 A4 2010 HSC 13 MC

The number of hours that it takes for a block of ice to melt varies inversely with the temperature. At 30°C it takes 8 hours for a block of ice to melt.

How long will it take the same size block of ice to melt at 12°C?

(A) 3.2 hours

(B) 20 hours

(C) 26 hours

(D) 45 hours

---

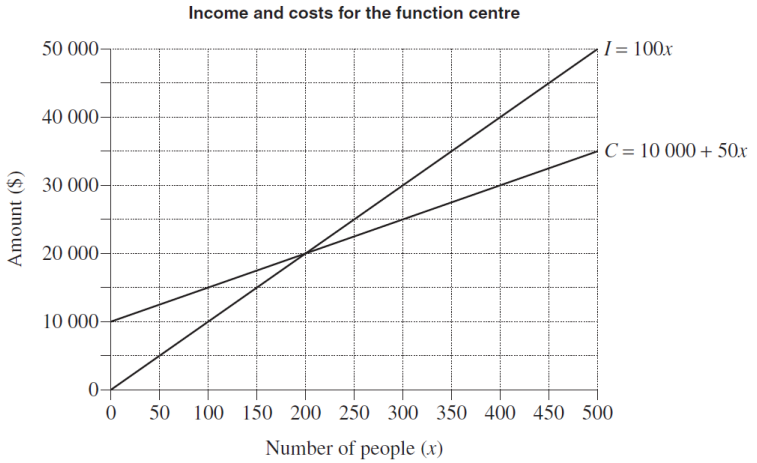
10. Algebra, STD2 A4 2011 HSC 20 MC

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

---

11. Algebra, STD2 A1 2013 HSC 21 MC

Which equation correctly shows r as the subject of $S = 800(1 - r)$?

(A) $r = \dfrac{800 - S}{800}$

(B) $r = \dfrac{S - 800}{800}$

(C) $r = 800 - S$

(D) $r = S - 800$

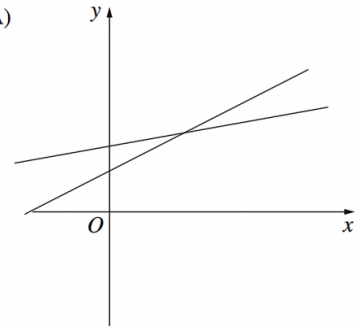
---

12. Algebra, STD2 A4 2004 HSC 16 MC

George drew a correct diagram that gave the solution to the simultaneous equations $y = 2x - 5$ and $y = x + 6$.

Which diagram did he draw?

(A)



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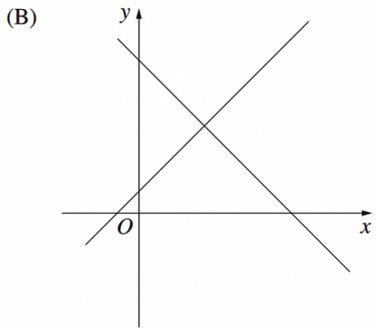
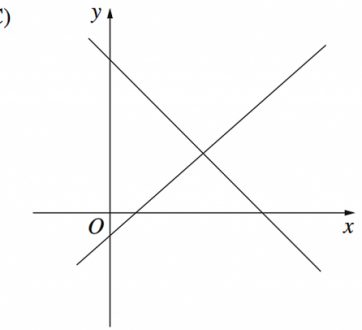


(C)



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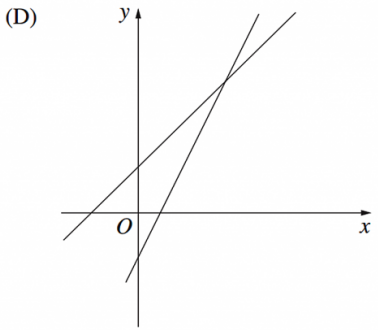

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13. Algebra, STD2 A2 2004 HSC 22 MC

John knows that

- one Australian dollar is worth 0.62 euros
- one Vistabella dollar ($\$V$) is worth 1.44 euros.

John changes 25 Australian dollars to Vistabella dollars.

How many Vistabella dollars will he get?

(A) $\$V10.76$

(B) $\$V22.32$

(C) $\$V28.00$

(D) $\$V58.06$

---

14. Algebra, STD2 A2 2005 HSC 17 MC

The total cost, $\$C$, of a school excursion is given by $C = 2n + 5$, where n is the number of students.

If three extra students go on the excursion, by how much does the total cost increase?

(A) $\$6$

(B) $\$11$

(C) $\$15$

(D) $\$16$

---

15. Algebra, STD2 A1 2007 HSC 19 MC

Which of the following correctly expresses T as the subject of $B = 2\pi\left(R + \dfrac{T}{2}\right)$?

(A) $T = \dfrac{B}{\pi} - 2R$

(B) $T = \dfrac{B}{\pi} - R$

(C) $T = 2R - \dfrac{B}{\pi}$

(D) $T = \dfrac{B}{4\pi} - \dfrac{R}{2}$

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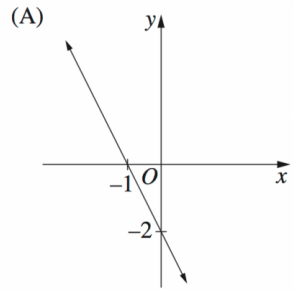
16. Algebra, STD2 A2 2014 HSC 7 MC

Which of the following is the graph of $y = 2x - 2$?

(A)



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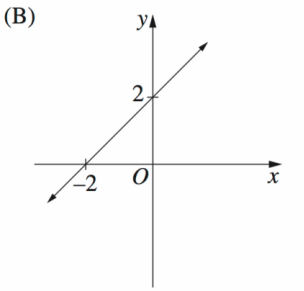
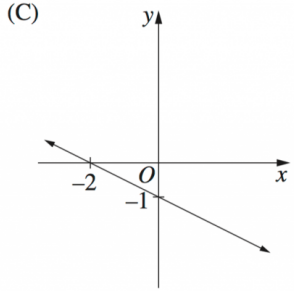
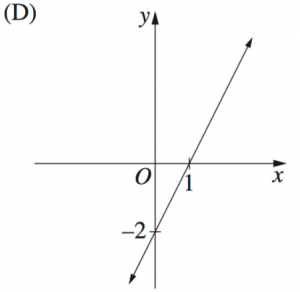


(C)



(D)



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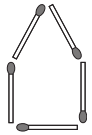
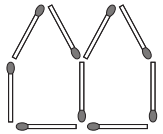
17. Algebra, STD2 A2 2017 HSC 20 MC

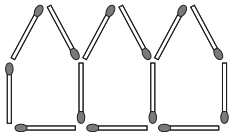
A pentagon is created using matches.



By adding more matches, a row of two pentagons is formed.



Continuing to add matches, a row of three pentagons can be formed.



Continuing this pattern, what is the maximum number of complete pentagons that can be formed if 100 matches in total are available?

A. 25

B. 24

C. 21

D. 20

---

18. Algebra, STD2 A1 2019 HSC 11 MC

Which of the following correctly expresses y as the subject of the formula $3x - 4y - 1 = 0$

A. $y = \frac{3}{4}x - 1$

B. $y = \frac{3}{4}x + 1$

C. $y = \frac{3x - 1}{4}$

D. $y = \frac{3x + 1}{4}$

---

19. Algebra, STD2 A1 2014 HSC 4 MC

Young's formula below is used to calculate the required dosages of medicine for children aged 1–12 years.

$$\text{Dosage} = \frac{\text{age of child (in years)} \times \text{adult dosage}}{\text{age of child (in years)} + 12}$$

How much of the medicine should be given to an 18-month-old child in a 24-hour period if each adult dosage is 45 mL? The medicine is to be taken every 6 hours by both adults and children.

(A) 5 mL

(B) 20 mL

(C) 27 mL

(D) 30 mL

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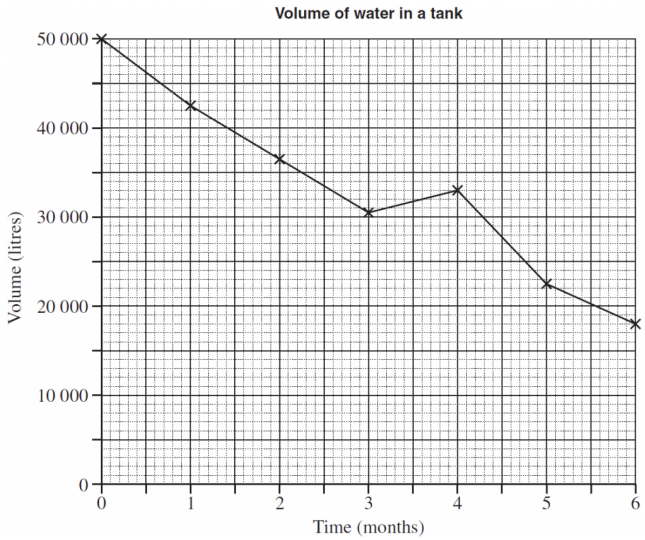
20. Algebra, STD2 A2 2009 HSC 13 MC

The volume of water in a tank changes over six months, as shown in the graph.



Consider the overall decrease in the volume of water.

What is the average percentage decrease in the volume of water per month over this time, to the nearest percent?

(A) 6%

(B) 11%

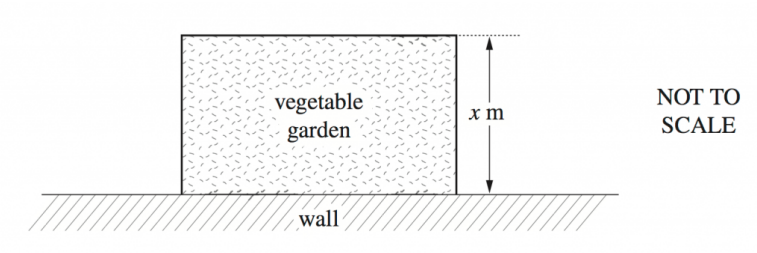
(C) 32%

(D) 64%

---

21. Algebra, STD2 A4 2013 HSC 22 MC

Leanne wants to build a rectangular vegetable garden in her backyard. She has 20 metres of fencing and will use a wall as one side of the garden. The plan for her garden is shown, where x metres is the width of her garden.



Which equation gives the area, A, of the vegetable garden?

(A) $A = 10x - x^2$

(B) $A = 10x - 2x^2$

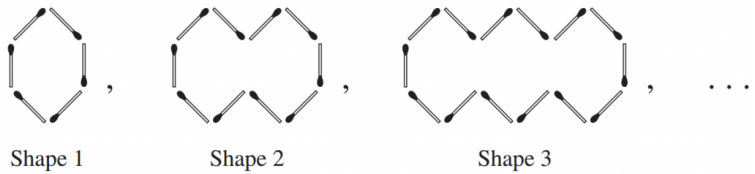
(C) $A = 20x - x^2$

(D) $A = 20x - 2x^2$

---

22. Algebra, STD2 A2 2007 HSC 18 MC

Chris started to make this pattern of shapes using matchsticks.



If the pattern of shapes is continued, which shape would use exactly 486 matchsticks?

(A) Shape 96

(B) Shape 97

(C) Shape 121

(D) Shape 122

---

23. Algebra, STD2 A1 2007 HSC 24b

The distance in kilometres (D) of an observer from the centre of a thunderstorm can be estimated by counting the number of seconds (t) between seeing the lightning and first hearing the thunder.

Use the formula $D = \frac{t}{3}$ to estimate the number of seconds between seeing the lightning and hearing the thunder if the storm is 1.2 km away. *(1 mark)*

---

24. Algebra, STD2 A1 SM-Bank 5

Fried's formula is used to calculate the medicine dosages for children aged 1-2 years.

$$\text{Child dosage} = \frac{\text{Age(in months)} \times \text{adult dosage}}{150}$$

Ben is 1.5 years old and receives a daily dosage of 450 mg of a medicine.

According to Fried's formula, what would the appropriate adult daily dosage of the medicine be? *(2 marks)*

---

25. Algebra, STD2 A1 SM-Bank 9

The volume of a sphere is given by $V = \frac{4}{3}\pi r^3$ where r is the radius of the sphere.

If the volume of a sphere is $220\ \text{cm}^3$, find the radius, to 1 decimal place. *(3 marks)*

---

26. Algebra, STD2 A2 2014 HSC 26f

The weight of an object on the moon varies directly with its weight on Earth. An astronaut who weighs 84 kg on Earth weighs only 14 kg on the moon.

A lunar landing craft weighs 2449 kg when on the moon. Calculate the weight of this landing craft when on Earth. *(2 marks)*

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27. Algebra, STD2 A1 SM-Bank 12

Make F the subject of the equation $C = \frac{5}{9}(F - 32)$. *(2 marks)*

---

28. Algebra, STD2 A1 2014 HSC 29b

Blood alcohol content of males can be calculated using the following formula

$$BAC_{\text{Male}} = \frac{10N - 7.5H}{6.8M}$$

where N is the number of standard drinks consumed

H is the number of hours drinking

M is the person's mass in kilograms

What is the maximum number of standard drinks that a male weighing 84 kg can consume over 4 hours in order to maintain a blood alcohol content (BAC) of less than 0.05? *(3 marks)*

---

29. Algebra, STD2 A4 SM-Bank 4

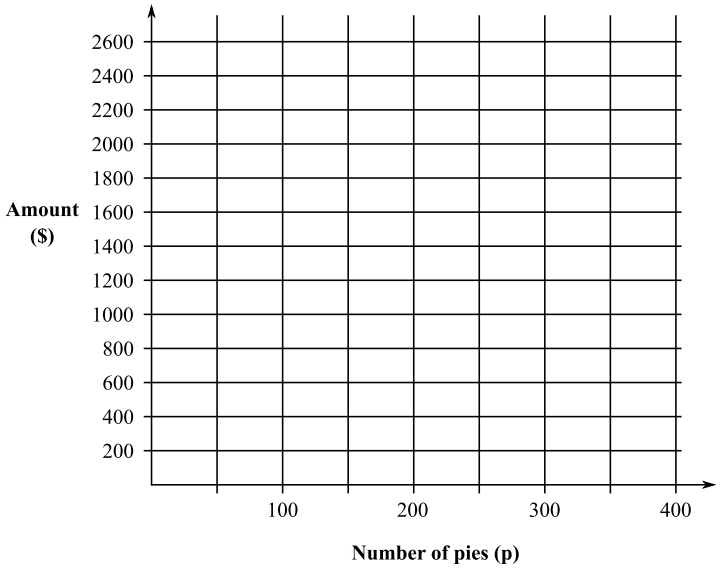
Penny is a baker and makes meat pies every day.

The cost of making p pies, $\$C$, can be calculated using the equation

$$C = 675 + 3.5p$$

Penny sells the pies for $5.75 each, and her income is calculated using the equation

$$I = 5.75p$$



(i) On the graph, draw the graphs of C and I. *(2 marks)*

(ii) On the graph, label the breakeven point and the loss zone. *(2 marks)*

---

30. Algebra, STD2 A1 2013 HSC 29a

Sarah tried to solve this equation and made a mistake in Line 2.

$$\frac{W+4}{3} - \frac{2W-1}{5} = 1 \quad \text{..... Line 1}$$

$$5W + 20 - 6W - 3 = 15 \quad \text{..... Line 2}$$

$$17 - W = 15 \quad \text{..... Line 3}$$

$$W = 2 \quad \text{..... Line 4}$$

Copy the equation in Line 1 into your writing booklet and continue your solution to solve this equation for W.

Show all lines of working. ***(2 marks)***

---

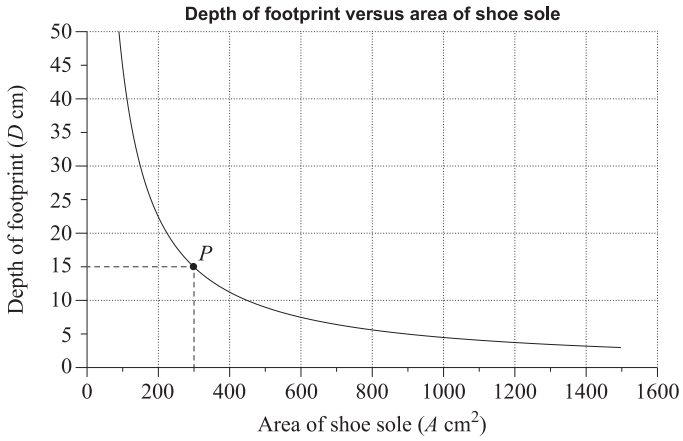
31. Algebra, STD2 A1 2018 HSC 28b

Solve the equation $\frac{2x}{5} + 1 = \frac{3x + 1}{2}$, leaving your answer as a fraction. ***(3 marks)***

---

32. Algebra, STD2 A4 2018 HSC 29c

When people walk in snow, the depth (D cm) of each footprint depends on both the area (A cm^2) of the shoe sole and the weight of the person. The graph shows the relationship between the area of the shoe sole and the depth of the footprint in snow, for a group of people of the same weight.



i. The graph is a hyperbola because D is inversely proportional to A. The point P lies on the hyperbola. Find the equation relating D and A. ***(2 marks)***

ii. A man from this group walks in snow and the depth of his footprint is 4 cm. Use your equation from part (i) to calculate the area of his shoe sole. ***(1 mark)***

---

33. Algebra, STD2 A1 2015 HSC 30d

Claire is driving on a motorway at a speed of 110 kilometres per hour and has to brake suddenly. She has a reaction time of 2 seconds and a braking distance of 59.2 metres.

Stopping distance can be calculated using the following formula

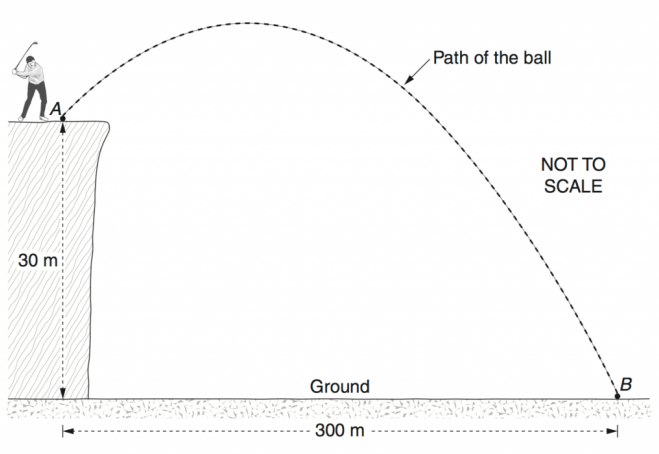
$$\text{stopping distance} = \{\text{reaction time distance}\} + \{\text{braking distance}\}$$

What is Claire's stopping distance. ***(2 marks)***

---

34. Algebra, STD2 A4 2012 HSC 30b

A golf ball is hit from point A to point B, which is on the ground as shown. Point A is 30 metres above the ground and the horizontal distance from point A to point B is 300 m.



The path of the golf ball is modelled using the equation

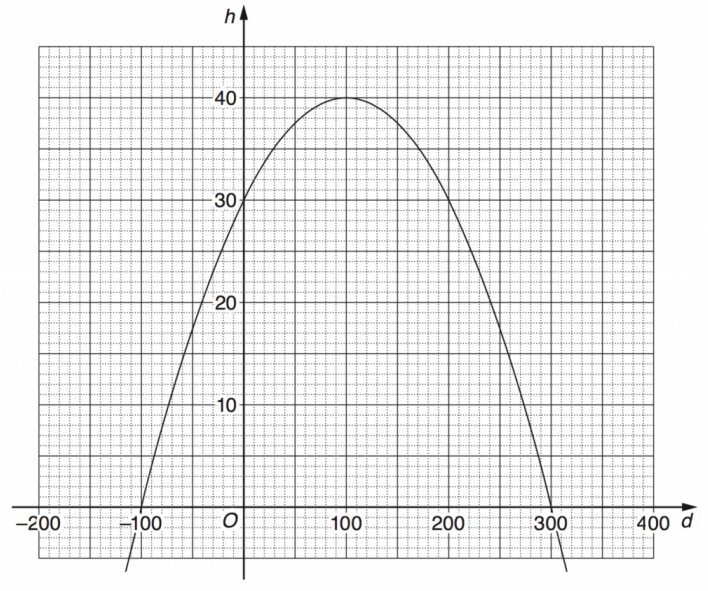
$$h = 30 + 0.2d - 0.001d^2$$

where

h is the height of the golf ball above the ground in metres, and

d is the horizontal distance of the golf ball from point A in metres.

The graph of this equation is drawn below.



(i) What is the maximum height the ball reaches above the ground? *(1 mark)*

(ii) There are two occasions when the golf ball is at a height of 35 metres.
What horizontal distance does the ball travel in the period between these two occasions? *(1 mark)*

(iii) What is the height of the ball above the ground when it still has to travel a horizontal distance of 50 metres to hit the ground at point B? *(1 mark)*

(iv) Only part of the graph applies to this model.

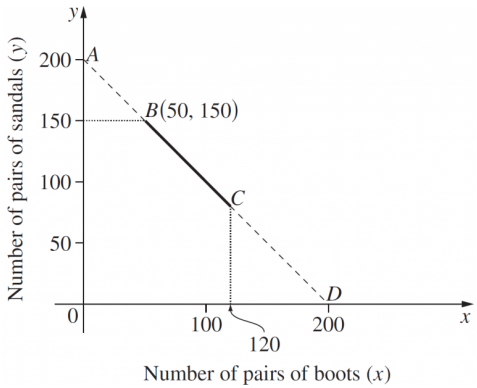
Find all values of d that are not suitable to use with this model, and explain why these values are not suitable. *(2 marks)*

35. 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)*

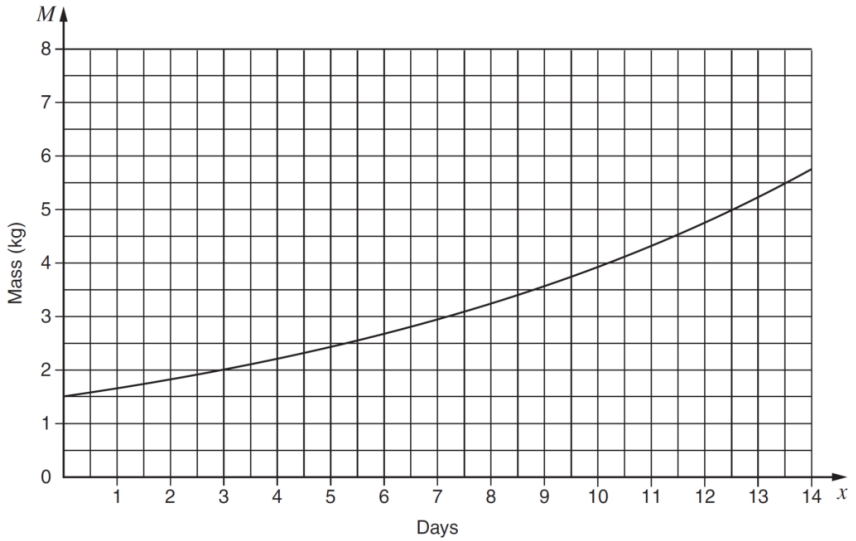
(iii) The profit per week, $\$P$, can be found by using the equation

$$P = 24x + 15y.$$

Compare the profits at B and C. *(2 marks)*

36. Algebra, STD2 A4 2016 HSC 29b

The mass M kg of a baby pig at age x days is given by $M = A(1.1)^x$ where A is a constant. The graph of this equation is shown.



(i) What is the value of A? *(1 mark)*

(ii) What is the daily growth rate of the pig's mass? Write your answer as a percentage. *(1 mark)*

Worked Solutions

1. Algebra, STD2 A4 2008 HSC 4 MC

$y = 3^x$ passes through (0, 1)

and is exponential

$\Rightarrow D$

---

2. Algebra, STD2 A4 2014 HSC 3 MC

Graph is a parabola that passes

through (0, 1)

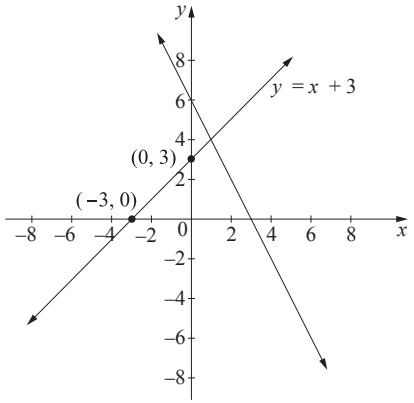
$\Rightarrow C$

---

3. Algebra, STD2 A4 2017 HSC 17 MC

Solution 1

From graph, intersection at (1,4)



$\Rightarrow B$

Solution 2

$y = 6 - 2x \quad \ldots (1)$

$y = x + 3 \quad \ldots (2)$

Substitute (2) into (1)

$x + 3 = 6 - 2x$

$3x = 3$

$x = 1$

When $x = 1, y = 4$

$\Rightarrow B$

---

4. Algebra, STD2 A2 2014 HSC 22 MC

Fuel used in short distance

$$= \frac{65}{100} \times 8.9 \text{ L} = 5.785 \text{ L}$$

Fuel used in long distance

$$= \frac{495}{100} \times 6.6 \text{ L} = 32.67 \text{ L}$$

$$\therefore \text{ Total Fuel} = 5.785 + 32.67$$
$$= 38.455 \text{ L}$$

$\Rightarrow B$

---

5. Algebra, STD2 A1 2014 HSC 17 MC

Paracetamol needed

$$= \frac{14}{2} \times 15 \text{ mg}$$
$$= 105 \text{ mg}$$

Since 120 mg is contained in 10 mL,

$\Rightarrow$ 105 mg is contained in

$$\frac{105}{120} \times 10 \text{ mL} = 8.75 \text{ mL}$$

$\Rightarrow B$

---

6. Algebra, STD2 A1 2010 HSC 7 MC

$$\frac{3M^2 + 5M}{6} = \frac{3 \times (-9)^2 + 5 \times (-9)}{6}$$
$$= \frac{(3 \times 81) - 45}{6}$$
$$= \frac{198}{6}$$
$$= 33$$

$\Rightarrow C$

♦♦ *Only 31% of students answered correctly!*

---

7. Algebra, STD2 A1 2011 HSC 21 MC

1st train

Travels 2hrs at 90km/h

♦ *Mean mark 49%*

$$\text{Distance} = \text{Speed} \times \text{Time}$$
$$= 90 \times 2$$
$$= 180 \text{ km}$$

2nd train

Travels 180 km in 1 hr 20 min $\left(\frac{4}{3} \text{ hrs}\right)$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$
$$= 180 \div \frac{4}{3}$$
$$= 180 \times \frac{3}{4}$$
$$= 135 \text{ km/h}$$

$\Rightarrow A$

---

8. Algebra, STD2 A1 2009 HSC 16 MC

♦ *Mean mark 38%*

$$T \propto \frac{1}{S}$$

$$T = \frac{k}{S}$$

As $S \uparrow, T \downarrow \Rightarrow$ cannot be B or D

C is incorrect because it graphs a linear relationship

$\Rightarrow A$

9. Algebra, STD2 A4 2010 HSC 13 MC

♦ *Mean mark 50%*

$$\text{Time to melt (T)} \propto \frac{1}{\text{Temp}}$$

$$\Rightarrow T = \frac{k}{\text{Temp}}$$

When $T = 8$ hrs, $\text{Temp} = 30$

$$8 = \frac{k}{30}$$

$$k = 240$$

When $\text{Temp} = 12$

$$T = \frac{240}{12}$$

$$= 20 \text{ hours}$$

$\Rightarrow B$

---

10. 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.

---

11. Algebra, STD2 A1 2013 HSC 21 MC

♦♦♦ *Mean mark 27%*

$$S = 800(1 - r)$$

$$1 - r = \frac{S}{800}$$

$$r = 1 - \frac{S}{800}$$

$$= \frac{800 - S}{800}$$

$\Rightarrow A$

---

12. Algebra, STD2 A4 2004 HSC 16 MC

By elimination

$y = 2x - 5$ cuts the y-axis at -5

$\therefore$ Cannot be A or B

$y = x + 6$ cuts the y-axis at 6

AND has a positive gradient

$\therefore$ Cannot be C

$\Rightarrow D$

---

13. Algebra, STD2 A2 2004 HSC 22 MC

John has 25 Aust dollars.

Converting to Euros

$$25 \text{ Aust} = 25 \times 0.62$$

$$= 15.5 \text{ Euros}$$

Converting to Vistabella dollars

$$15.5 \text{ Euros} = \frac{15.5}{1.44}$$

$$= \$\text{V}10.76$$

$\Rightarrow A$

---

14. Algebra, STD2 A2 2005 HSC 17 MC

$C = 2n + 5$

If n increases to $n + 3$

$$\begin{aligned} C &= 2(n + 3) + 5 \\ &= 2n + 6 + 5 \\ &= 2n + 11 \end{aligned}$$

$\therefore$ Total cost increases by \$6

$\Rightarrow A$

---

15. Algebra, STD2 A1 2007 HSC 19 MC

$$B = 2\pi\left(R + \frac{T}{2}\right)$$

$$\frac{B}{2\pi} = R + \frac{T}{2}$$

$$\frac{T}{2} = \frac{B}{2\pi} - R$$

$$T = \frac{B}{\pi} - 2R$$

$\Rightarrow A$

---

16. Algebra, STD2 A2 2014 HSC 7 MC

♦ *Mean mark 46%*

$y = 2x - 2$

By elimination

It has a y intercept of -2

$\Rightarrow$ Cannot be B or C

(–1, 0) from A doesn't satisfy equation

but (1, 0) from D does

$\Rightarrow D$

---

17. Algebra, STD2 A2 2017 HSC 20 MC

1 pentagon: 5 matches

2 pentagons: $5 + 4 = 9$

3 pentagons: $5 + 4 \times 2 = 13$

$\vdots$

n pentagons: $5 + 4(n - 1)$

$$\begin{aligned} 5 + 4(n - 1) &= 100 \\ 4n - 4 &= 95 \\ 4n &= 99 \\ n &= 24.75 \end{aligned}$$

$\therefore$ Complete pentagons possible = 24

$\Rightarrow$ B

---

18. Algebra, STD2 A1 2019 HSC 11 MC

♦ *Mean mark 50%.*

$$\begin{aligned} 3x - 4y - 1 &= 0 \\ 4y &= 3x - 1 \\ \therefore y &= \frac{3x - 1}{4} \end{aligned}$$

$\Rightarrow C$

---

19. Algebra, STD2 A1 2014 HSC 4 MC

♦ *Mean mark 42%*

$$\begin{aligned} \text{Dosage} &= \frac{1.5 \times 45}{1.5 + 12} \\ &= 5 \text{ mL} \end{aligned}$$

Since 1 dosage every 6 hrs

In 24 hours,

Medicine given $= 4 \times 5 = 20$ mL

$\Rightarrow B$

---

20. Algebra, STD2 A2 2009 HSC 13 MC

$$\begin{aligned}\text{Initial Volume} &= 50\,000 \text{ L}\\ \text{Final volume} &= 18\,000 \text{ L}\\ \text{Decrease} &= 50\,000 - 18\,000\\ &= 32\,000 \text{ L} \quad \text{(over 6 months)}\end{aligned}$$

♦ *Mean mark 48%*
COMMENT: Remember that % decrease requires the decrease in volume to be divided by the *original* volume (50,000L).

$$\begin{aligned}\text{Loss per month} &= \frac{32\,000}{6}\\ &= 5333.33... \text{ L per month}\\ \%\text{ loss per month} &= \frac{5333.33...}{50\,000}\\ &= 10.666...\ \%\end{aligned}$$

$\Rightarrow B$

21. Algebra, STD2 A4 2013 HSC 22 MC

$$\text{Length of garden} = (20 - 2x)$$

$$\begin{aligned}\text{Area} &= x(20 - 2x)\\ &= 20x - 2x^2\end{aligned}$$

$\Rightarrow D$

♦♦♦ *Mean mark 24% (lowest mean of any MC question in 2013 exam)*

22. Algebra, STD2 A2 2007 HSC 18 MC

Shape (S)	1	2	3
Matches (M)	6	10	14

Equation rule

$M = 4S + 2$

Find x when $M = 486$

$$\begin{aligned}486 &= 4S + 2\\ 4S &= 484\\ S &= 121\end{aligned}$$

$\therefore$ The 121st shape uses 486 matchsticks.

$\Rightarrow C$

23. Algebra, STD2 A1 2007 HSC 24b

$$D = \frac{t}{3}$$

When $D = 1.2$

$$\frac{t}{3} = 1.2$$

$t = 3.6$ seconds

24. Algebra, STD2 A1 SM-Bank 5

Substituting into the formula:

$$450 = \frac{18 \times \text{adult dosage}}{150}$$

$$\begin{aligned}\therefore \text{ Adult dosage} &= \frac{450 \times 150}{18}\\ &= 3750 \text{ mg}\end{aligned}$$

25. Algebra, STD2 A1 SM-Bank 9

$$V = \frac{4}{3}\pi r^3$$
$$3V = 4\pi r^3$$
$$r^3 = \frac{3V}{4\pi}$$

When $V = 220$

$$r^3 = \frac{3 \times 220}{4\pi}$$
$$= 52.521\ldots$$
$$\therefore r = \sqrt[3]{52.521\ldots}$$
$$= 3.744\ldots \quad \text{(by calc)}$$
$$= 3.7 \text{ cm} \quad \text{(to 1 d.p.)}$$

---

26. Algebra, STD2 A2 2014 HSC 26f

$w_{\text{moon}} \propto w_{\text{earth}}$

$\Rightarrow w_{\text{m}} = k \times w_{\text{e}}$

We know when $w_{\text{e}} = 84$, $w_{\text{m}} = 14$

$$\therefore 14 = k \times 84$$
$$k = \frac{14}{84} = \frac{1}{6}$$

If $w_{\text{m}} = 2449$ kg, find w_{e}

$$2449 = \frac{1}{6} \times w_{\text{e}}$$
$$w_{\text{e}} = 14\,694 \text{ kg}$$

$\therefore$ Landing craft weighs 14 694 kg on earth

---

27. Algebra, STD2 A1 SM-Bank 12

$$C = \frac{5}{9}(F - 32)$$
$$9C = 5(F - 32)$$
$$\frac{9C}{5} = F - 32$$
$$\therefore F = \frac{9C}{5} + 32$$

---

28. Algebra, STD2 A1 2014 HSC 29b

$$\text{BAC}_{\text{male}} = \frac{10N - 7.5H}{6.8M}$$

Find N for BAC < 0.05, given $H = 4$ and $M = 84$

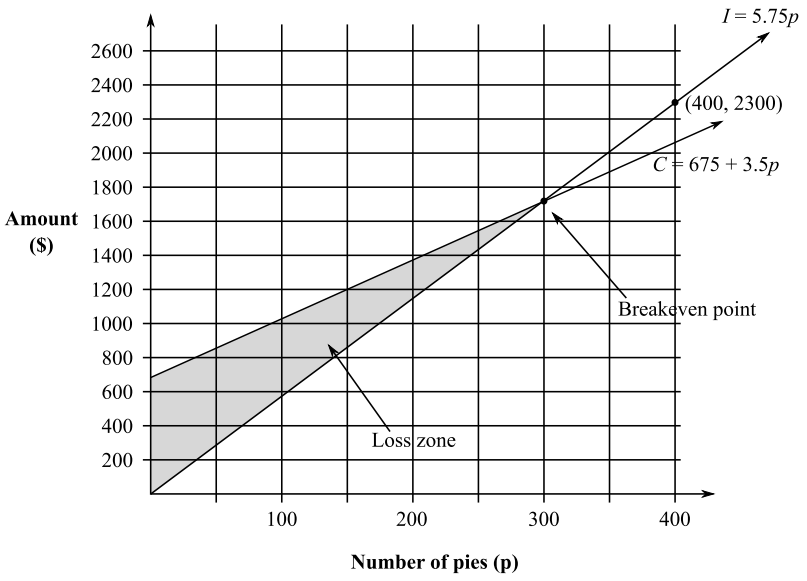
$$\frac{10N - 7.5(4)}{6.8(84)} < 0.05$$
$$10N - 30 < 0.05(571.2)$$
$$10N < 28.56 + 30$$
$$< 58.56$$
$$N < 5.856$$

$\therefore$ Max number of drinks is 5.

---

29. Algebra, STD2 A4 SM-Bank 4

(i)



(ii) Loss zone occurs when $C > I$, which is shaded in the diagram above.

30. Algebra, STD2 A1 2013 HSC 29a

$$\frac{W+4}{3} - \frac{2W-1}{5} = 1 \quad \text{... Line 1}$$

$$5W + 20 - 6W + 3 = 15 \quad \text{... Line 2}$$

$$23 - W = 15 \quad \text{... Line 2}$$

$$W = 8 \quad \text{... Line 4}$$

♦♦ *Mean mark 27%*
STRATEGY: The RHS of the equation increases from 1 to 15 (from Line 1 to Line 2), indicating both sides must have been multiplied by 15.

31. Algebra, STD2 A1 2018 HSC 28b

$$\underbrace{\frac{2x}{5} + 1}_{\text{multiply x10}} = \underbrace{\frac{3x+1}{2}}_{\text{multiply x10}}$$

$$4x + 10 = 15x + 5$$

$$11x = 5$$

$$x = \frac{5}{11}$$

♦ *Mean mark 35%.*

32. Algebra, STD2 A4 2018 HSC 29c

i. $D \propto \frac{1}{A} \Rightarrow D = \frac{k}{A}$

When $D = 15, A = 300$

$$15 = \frac{k}{300}$$

$$\therefore k = 4500$$

♦♦ *Mean mark part (i) 22%.*

ii. $4 = \frac{4500}{A}$

$$\therefore A = \frac{4500}{4}$$

$$= 1125 \text{ cm}^2$$

♦♦ *Mean mark part (ii) 33%.*

33. Algebra, STD2 A1 2015 HSC 30d

♦ *Mean mark 34%.*

$$110 \text{ km/hr} = 110\,000 \text{ m/hr}$$
$$= \frac{110\,000}{60 \times 60} \text{ m/sec}$$
$$= 30.555\ldots \text{ m/sec}$$

$$\text{Reaction time distance} = 2 \times 30.555\ldots$$
$$= 61.11\ldots \text{ metres}$$

$\therefore$ Stopping distance

$=$ Reaction time distance + braking distance

$= 61.11\ldots + 59.2$

$= 120.311\ldots$

$= 120.3$ metres (to 1 d.p.)

34. Algebra, STD2 A4 2012 HSC 30b

(i) Max height $= 40$m

COMMENT: With a mean mark of 92%, a classic example of low hanging fruit in later questions for students who budget time well.

(ii) From graph

$h = 35$ when $x = 30$ and $x = 170$

$\therefore$ Horizontal distance $= 170 - 30$

$= 140$ m

(ii) Ball hits ground at $x = 300$

$\Rightarrow$ Need to find y when $x = 250$

From graph, $y = 17.5$m when $x = 250$

$\therefore$ Height of ball is 17.5 m at a horizontal distance of 50m before B.

MARKER'S COMMENT: Responses in the range $17 \leq h \leq 18$ were deemed acceptable estimates read off the graph.

(iv) Values of d not suitable.

If $d < 0$, it assumes the ball is hit away from point B. This is not the case in our example.

If $d > 300$, h becomes negative which is not possible given the ball cannot go below ground level.

♦♦♦ *Mean mark 12%*

MARKER'S COMMENT: Many students did not refer to the domain $d > 300$ as unsuitable to the model. Be careful to examine the *whole* domain in similar questions.

35. 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

♦ *Mean mark 49%*

Since the max amount of sandals $= 150$

$\Rightarrow y$ cannot > 150

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

(iii) At B, $x = 50$, $y = 150$

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

$= 1200 + 2250$

$= \$3450$

♦ *Mean mark 40%.*

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.

---

36. Algebra, STD2 A4 2016 HSC 29b

(i) When $x = 0$,

$1.5 = A(1.1)^0$

$\therefore A = 1.5$ kg

♦ *Mean mark 48%.*
COMMENT: Common ADV/STD2 content in new syllabus.

(ii) Daily growth rate

$= 0.1$

$= 10\%$

♦♦♦ *Mean mark part (ii) 6%.*
MARKER'S COMMENT: Interpretation of the exponential was very poorly understood.
