Firrhill High School

National 5 Maths

30 Past Paper Challenge

Solutions

2003 - 2017

Credit Paper 1 2003

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1. Given 5.04 + 8.4 ÷ 7

Remembering BODMAS we do the Division first then the Addition.

5.04 + 1.2 = 6.24

2. $\frac{2}{7}(1\frac{3}{4}+\frac{3}{8})$ Given

Using the rules for fractions we have

Make top heavy and find a common factor for the denominator then do the Brackets. $\frac{7}{4}+\frac{3}{8}=\frac{14+3}{8}=\frac{17}{8}$

We then do the Multiplication

$$\frac{2}{7}\cdot\frac{17}{8}=\frac{17}{28}$$

3. Given $3(2x-4)-4(3x+1)$

Using the rules of arithmetic to simplify we get

$$6x-12-12x+4=-6x-16$$

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4. Given $f(x) = 7 - 4x$

(a) For $f(-2)$

We have $f(-2) = 7 - 4(-2) = 15$

(b) For $f(t) = 9$

We have $7 - 4t = 9$ $\quad t = \dfrac{9-7}{-4}$ $\quad t = \dfrac{-1}{2}$

5. Given $2x^2 - 7x - 15$

Factorising we get

$(2x + 3)(x - 5)$

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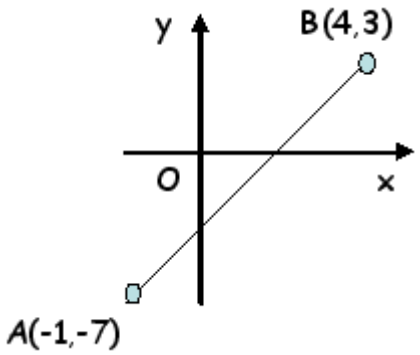
6. Given the diagram below.



(a) Gradient is given by

$$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-(-7)}{4-(-1)} = \frac{10}{5} = 2$$

(b) Given AB cuts y-axis at (0,-5), the equation of the line is given by

$$y = 2x - 5$$

(c) Given (3k, k) lies on the line then k equals

$$k = 2(3k) - 5 = 6k - 5 \qquad k = \frac{5}{5} = 1$$

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7. Given the information below

3nights + 2breakfast Bill £145

(a) Equation is $3n + 2b = 145$

5nights + 3breakfast Bill £240

(b) Equation is $5n + 3b = 240$

(c) One breakfast costs.

$3n + 2b = 145$ Equation 1
$5n + 3b = 240$ Equation 2

Multiple equation 1 by 5 and equation 2 by 3 and then subtract equation 2 from equation 1 we get

$15n + 10b = 725$
$15n + 9b = 720$

$b = 725 - 720 = 5$

Breakfast costs £5

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8. Given the information

red, green, blue, yellow All numbered 1 - 10

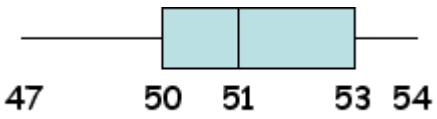
(a) Probability of picking a 6 is:

$$\frac{4}{40} = 0.1$$

(b) Probability of picking a yellow 6 is:

$$\frac{1}{40} = 0.025$$

9. Given



Matchboxes containing less than 50 matches correspond to the lower quartile.

Hence 25% contain fewer than 50 matches.

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10. Given the ratio information

Parent's	teacher	pupils
1	3	15

(a) For 45 pupils we should have 3 teachers (3x3 = 9)

(b) Given 100 tickets we need groups of 19.

So we have

$\frac{100}{19} = 5.263$ Maximum number of groups is 5

There are 15 pupils in each group hence we have

$15 \cdot 5 = 75$

11. Given $1, 3, 5, 7, 9$

(a) Sum of first 3 numbers is $S_3 = 1 + 3 + 5 = 9$

(b) Sum of first n numbers is $S_n = n^2$

$n = 1 \quad 1^2$

$n = 2 \quad 1 + 3 = 4 = 2^2$

$n = 3 \quad 1 + 3 + 5 = 9 = 3^2$ ..etc

(c) Sum of first n numbers is

$(n + 1)^{th}$ term $(n + 1)^2 = n^2 + 2n + 1$

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12. Given $8^{\frac{2}{3}}$

(a) We have $8 = 2^3$

$$8^{\frac{2}{3}} = 2^{3\cdot\frac{2}{3}} = 2^2 = 4$$

(b) Given $\dfrac{\sqrt{24}}{\sqrt{2}}$

$$\frac{\sqrt{24}}{\sqrt{2}} = \frac{\sqrt{12}\cdot\sqrt{2}}{\sqrt{2}} = \sqrt{12} = \sqrt{4}\cdot\sqrt{3} = 2\sqrt{3}$$

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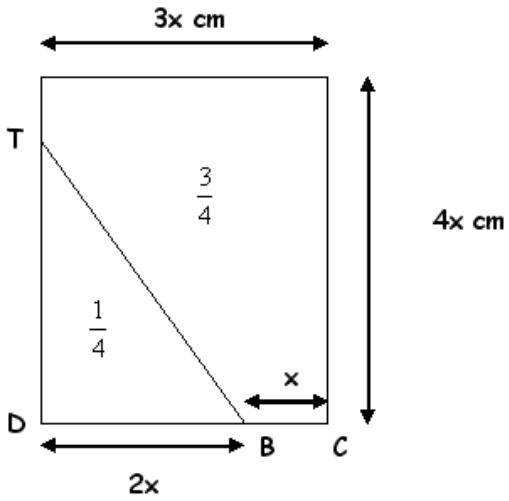
13. Given diagram below



Whole area of board is $3x \cdot 4x = 12x^2$

Hence area TBD is $\frac{1}{4} \cdot 12x^2 = 3x^2$

Using the area formula for a triangle we have

$$A = \frac{1}{2} \cdot TD \cdot DB \cdot \sin(D) \qquad \sin(D) = \sin(90)^\circ = 1$$

$$3x^2 = \frac{1}{2} TD \cdot 2x \cdot 1$$

$$TD = \frac{6x^2}{2x} = 3x$$

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1. From the information given we have

Bacteria at 12:00 hrs 5000

Rate of increase of bacteria 0.6%perhour

Hence at 3pm there will be

$b = 5000(1 + .006)^3 = 5090$ To 3 significant figures

2. From the information given we have

49 44 41 52 47 43

(a) The mean of the data is.

$$\text{mean} = \frac{49 + 44 + 41 + 52 + 47 + 43}{6} = 46$$

(b) The standard deviation is

$$\Sigma x^2 = 49^2 + 44^2 + 41^2 + 52^2 + 47^2 + 43^2 = 12780$$
$$(\Sigma x)^2 = 76176$$

$$\text{Standard}_{\text{dev}} = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}} = \sqrt{\frac{12780 - \frac{76176}{6}}{6-1}} = 4.1$$

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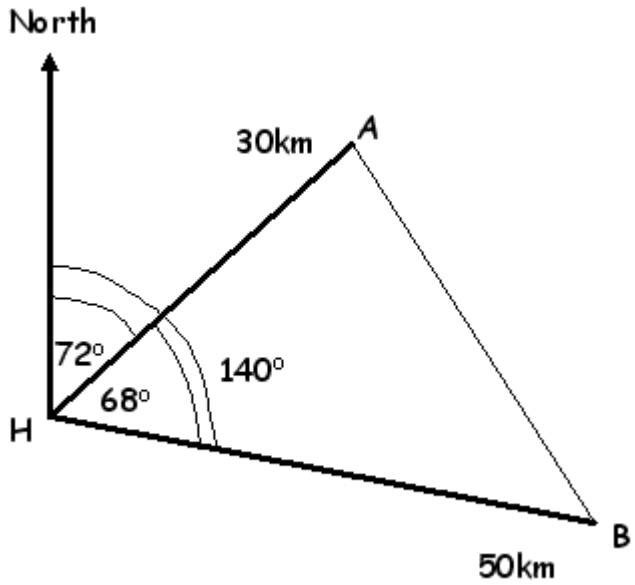
(c) One valid comparison between the sugar with standard deviation 2.6 and the milk is:-

There is less variation in sugar prices than milk.

3. From the information given we can deduce the following:-



To find the distance between A and B we use the Cosine Rule.

$h^2 = a^2 + b^2 - 2 \cdot a \cdot b \cdot \cos(H)$ $H = 68^o$ $a = 30\text{km}$ $c = 50\text{km}$

$$h = \sqrt{\left(30^2 + 50^2 - 2 \cdot 30 \cdot 50 \cdot \cos\left(68^o\right)\right.}$$

$h = 47.7\text{km}$

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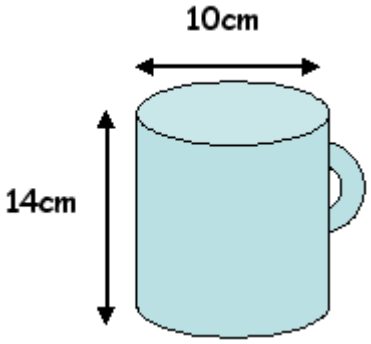
4. From the information given we have



(a) The volume is given by

$$\text{Volume} = \text{circle}_{\text{area}} \cdot \text{length}$$

$$\text{Volume} = \pi \cdot (5)^2 \cdot 14 = 1100\text{ml}$$

(b) If 600ml is poured in the height of liquid will be

$$\frac{600}{1100} \cdot 14 = 7.6\text{cm}$$

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5. Given the formula:-

$$d = \frac{n(n-3)}{2}$$

n = number of sides
d = number of diagonals
For a polygon of 20 diagonals the number of sides is given by

$$20 = \frac{n(n-3)}{2}$$

$$n^2 - 3n - 40 = 0$$

$$(n-8)(n+5) = 0$$

$$n = 8 \quad \text{or} \quad n = -5$$

Since we cannot have a negative number of sides we choose $n = 8$

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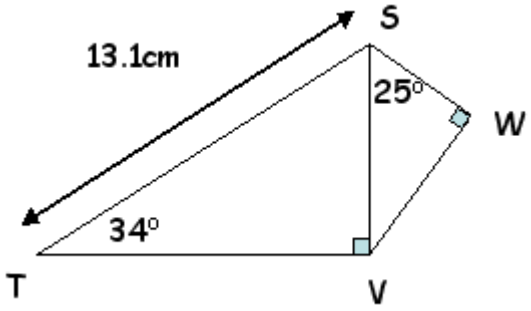
6. From the information given we have



(a) To find the length of SW we have

$$SV = 13.1 \cdot \sin(34^\circ) = 7.33\text{cm}$$

$$SW = 7.33 \cdot \cos(25^\circ) = 6.64\text{cm}$$

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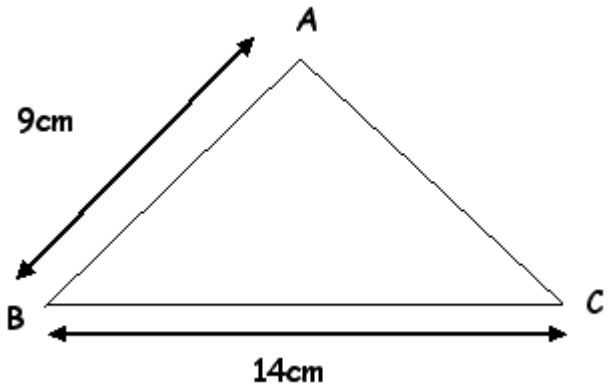
7. From information given we have



$\text{Area} = 38\text{cm}^2$

To find angle ABC we have

$$\text{Area} = \frac{1}{2}\cdot a\cdot c\cdot \sin(B)$$

$$38 = \frac{1}{2}\cdot 9\cdot 14\cdot \sin(B)$$

$$\sin(B) = \frac{38}{63}$$

$$B = \sin^{-1}\left(\frac{38}{63}\right) = 37^{\circ}$$

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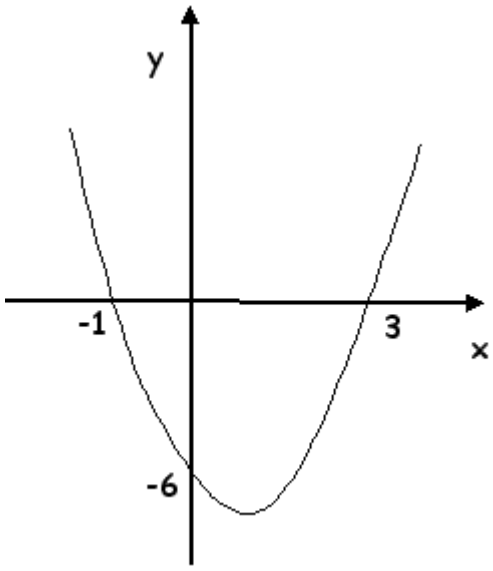
8. From the information given we have



$y = (k(x - a))(x - b)$

(a) Values for a and b are $a = -1$ $b = 3$

(b) For the value of k we have $x = 0$ $y = -6$

$$-6 = k(0 + 1)(0 - 3)$$

$$k = \frac{-6}{-3} = 2$$

(c) For the co-ordinates of the minimum turning point we have

By symmetry the x co-ordinate is

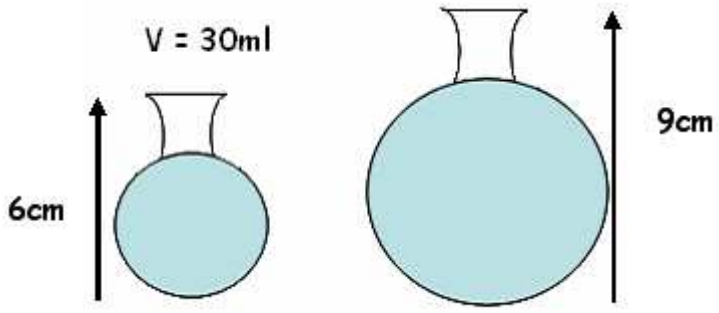
$$\frac{(-1+3)}{2} = 1$$

Substitute x = 1 in equation to get y co-ordinate

$$y = 2(1+1)(1-3) = -8$$

Hence co-ordinates are (1,-8)

9. From the information given we have



Since the bottles are mathematically similar the larger bottle has volume

$$V = \left(\frac{9}{6}\right)^3 \cdot 30 = 101.25\text{ml}$$

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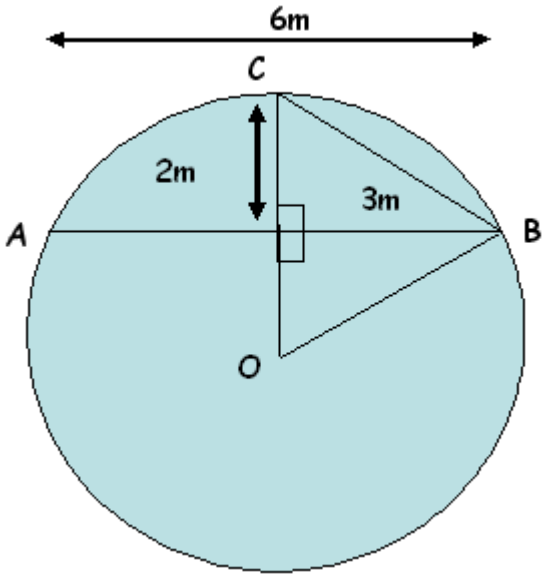
10. From the information given we have



To calculate BO we have by

Angle OCB = $\tan^{-1}\left(\frac{3}{2}\right) = 56.3^{o}$

Angle ABC = $180^{o} - 90^{o} - 56.3^{o} = 33.7^{o}$

Since OC = OB the radius of circle then OCB is an isosceles triangle.

Hence

Angle OBC = 56.3^{o} and angle OBA = $56.3^{o} - 33.7^{o} = 22.6^{o}$

Hence by basic trig. $OB = \frac{3}{\cos\left(22.6^{o}\right)} = 3.25\text{cm}$

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11. From the information given (assuming units should be in kilometres) we have

(a) $$\text{time} = \frac{\text{distance}}{\text{speed}} = \frac{x}{57}\text{hrs}$$

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{x}{\frac{x}{50}} = 50\text{kmhr}^{-1}$$

(b) Hence average speed for whole journey is

$$\frac{75\text{kmhr}^{-1} + 50\text{kmhr}^{-1}}{2} = 62.5\text{kmhr}^{-1}$$

1) Evaluate

$$6.2 - (4.53 - 1.1)$$

Sol^{n}

$$6.2 - (4.53 - 1.1)$$

$$= \quad 6.2 - 3.43$$

$$= \quad 2.77$$

4.53	6.20
$-\ 1.10$	$-\ 3.43$
3.43	2.77

2) Evaluate

$$\frac{2}{5} \text{ of } 3\frac{1}{2} + \frac{4}{5}$$

Sol^{n}

$$\frac{2}{5} \text{ of } 3\frac{1}{2} + \frac{4}{5}$$

$$= \quad \frac{\cancel{2}^{1}}{5} \times \frac{7}{\cancel{2}_{1}} + \frac{4}{5}$$

$$= \quad \frac{7}{5} + \frac{4}{5}$$

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

$$= \quad 2\frac{1}{5}$$

3) $A = 2x^2 - y^2$

Calculate the value of A when $x = 3$ and $y = -4$

Sol^n

$A = 2x^2 - y^2$

$A = 2(3^2) - (-4^2)$

$A = 2(9) - (16)$

$A = 18 - 16$

$\underline{\underline{A = 2}}$

4) Simplify $\dfrac{3}{m} + \dfrac{4}{(m+1)}$

Sol^n

$$\frac{3}{m} + \frac{4}{(m+1)}$$

$$= \frac{3(m+1)}{m(m+1)} + \frac{4m}{m(m+1)}$$

$$= \frac{3(m+1) + 4m}{m(m+1)}$$

$$= \frac{3m + 3 + 4m}{m(m+1)}$$

$$= \underline{\underline{\frac{7m + 3}{m(m+1)}}}$$

5) The average monthly temperature in a holiday resort was recorded in degree Celsius (^oC)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Average Temperature (^oC)	1	8	8	10	15	22	23	24	20	14	9	4

Draw a suitable statistical diagram to illustrate the median and the quartiles of this data

Sol^n

Require an organised list

Stem and Leaf

Temperatures recorded

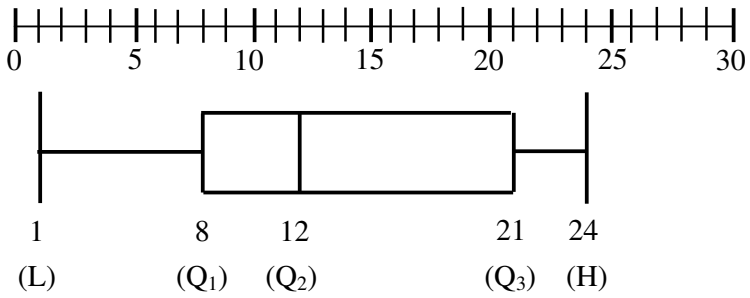
0	1 4 8 8 9
1	0 4 5
2	0 2 3 4

$n = 12$ Key $2 \mid 0 = 20\,^oC$

Five figure Summary

Lowest (L)	= 1
Lower Quartile (Q_1)	= 8
Median (Q_2)	= 12
Upper Quartile (Q_3)	= 21
Highest (H)	= 24

Box Plot



6) Marmalade is on special offer

Each jar on special offer contains 12.5% more than the standard jar

A jar on special offer contains 450g of marmalade

How much does the standard jar contain?

Sol^{n}

	450 g	(112.5 %)	$\frac{9}{8}$	
÷ 9			÷ 9	
	$\frac{450}{9}$ g	(12.5 %)	$\frac{1}{8}$	
=	50 g			
× 8			× 8	
	50 g × 8		$\frac{8}{8}$	
=	$\underline{\underline{400}}$ g	(100 %)		

100 %	= 1
50 %	= $\frac{1}{2}$
25 %	= $\frac{1}{4}$
12.5 %	= $\frac{1}{8}$

The standard jar contains $\underline{\underline{400}}$ g

7) John's school sells 1200 tickets for a raffle.
John buys 15 tickets.

John's church sells 1800 tickets for a raffle.
John buys 20 tickets.

In which raffle has he a better chance of winning first prize?
Show clearly all your working.

Sol^{n}

School $\frac{15}{1200}$ Church $\frac{20}{1800}$

(÷ 5 top and bottom) (÷ 10 top and bottom)

$\frac{3}{240}$ $\frac{2}{180}$

(÷ 3 top and bottom) (÷ 2 top and bottom)

$\frac{1}{80}$ $\frac{1}{90}$

John has a better chance of winning the first prize in the school raffle

8) 7, –2, 5, 3, 8

In the sequence above, each term after the first two terms is the sum of the previous two terms.

For example: 3rd term = 5 = 7 + (–2)

(*a*) A sequence follows the above rule.

The first term is x and the second term is y.

The fifth term is 5

x, y, _ , _ , 5

Show that $2x + 3y = 5$

(*b*) Using the same x and y, another sequence follows the above rule.

The first term is y and the second term is x.

The sixth term is 17.

y, x, _ , _ , 17

Write down another equation in x and y.

(*c*) Find the values of x and y.

Sol^n

(*a*) x, y, _ , _ , 5

x, y, $x + y$, $x + 2y$, $2x + 3y$

$\underline{2x + 3y = 5}$

(*b*) y, x, _ , _ , _ , 17

y, x, $y + x$, $y + 2x$, $2y + 3x$, $3y + 5x$

$\underline{3y + 5x = 17}$

(*c*) $3y + 2x = 5$ $(\times -1)$

$\underline{3y + 5x = 17}$

$-3y - 2x = -5$

$\underline{3y + 5x = 17}$ Add

$3x = 12$

$\underline{\underline{x = 4}}$

$3y + 2x = 5$

$3y + 2(4) = 5$

$3y + 8 = 5$

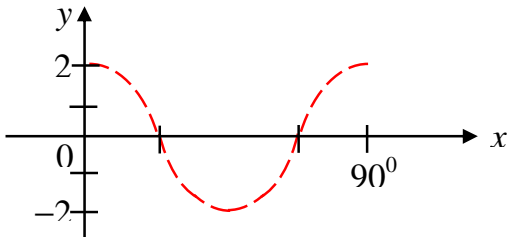
($-$ 8 both sides)

$3y = -3$

($\div$ 3 both sides)

$\underline{\underline{y = -1}}$

8) The graph of $y = a \cos bx^{o}$, $0 \le x \le 90$, is shown below.



Write down the values of a and b.

Sol^{n}

$y = a \cos bx^{o}$

a is the amplitude

max. value = 2
min. value = −2
} Difference = 4

$a = \frac{4}{2} = 2$

$a = 2$

b is the repeat

graph repeats $\frac{360}{90}$ = 4 times in 360^{0}

$b = 4$

$y = 2 \cos 4x^{o}$

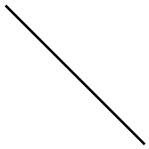
10) Two variables x and y are connected by the relationship $y = ax + b$

Sketch a possible graph of y against x to illustrate this relationship when a and b are each less then zero.

Sol^n

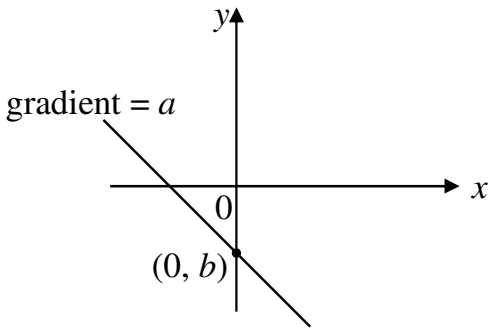
$y = ax + b$ $\quad$ a = gradient (< 0)

i.e. negative gradient



b = y intercept (< 0)

i.e. point $(0,b)$ where $b < 0$



11) (a) Simplify $2\sqrt{75}$ $\quad$ (*b*) Evaluate $2^0 + 3^{-1}$

Sol^n

(*a*) $2\sqrt{75} = 2\sqrt{25}\sqrt{3}$

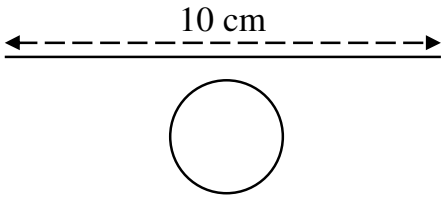
$= (2)(5)(\sqrt{3})$

$= \underline{10\sqrt{3}}$

(*b*) $2^0 + 3^{-1} = 1 + \frac{1}{3}$

$= \underline{\underline{1\,^{1}/_{3}}}$

12) A piece of gold wire 10 centimetres long is made into a circle.



The circumference of the circle is equal to the length of the wire.

Show that the area of the circle is **exactly** $\frac{25}{\pi}$ square centimetres.

Sol^{n}

$C = \pi d = 10$

$\pi d = 10$

$d = \frac{10}{\pi}$

$\left(r = \frac{d}{2} \right)$

$r = \frac{10}{2\pi}$

$r = \frac{5}{\pi}$

$A = \pi r^2$

$\left(r = \frac{5}{\pi} \right)$

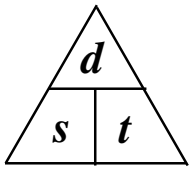
$A = (\pi)\left(\frac{5}{\pi}\right)^2$

$A = (\pi)\left(\frac{25}{\pi^2} \right)$

$A = \frac{25}{\pi}$

1) Radio signals travel at a speed of 3×10^8 metres per second.
A radio signal from Earth to a space probe takes 8 hours.
What is the distance from Earth to the probe?
Give your answer **in scientific notation**.

Sol^n



$d = s \times t$

$= (3 \times 10^8)$ metres/sec $\times (8 \times 60 \times 60)$ secs

$= 3 \times 10^8 \times 8 \times 60 \times 60$

$= 3 \times 10^8 \times 28800$

$= 3 \times 10^8 \times 2.88 \times 10^4$

$= 3 \times 2.88 \times 10^8 \times 10^4$

$= 8.64 \times 10^{(8+4)}$

$= \underline{8.64 \times 10^{12} \text{ metres}}$

$= \dfrac{8.64 \times 10^{12}}{10^3}$

$= 8.64 \times 10^{(12-3)}$

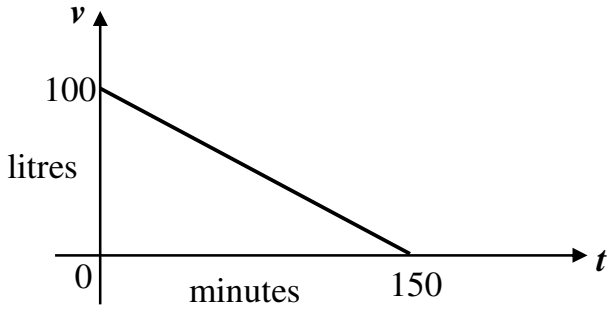
$= \underline{8.64 \times 10^9 \text{ kilometres}}$

8 hours
= 8 hrs × 60 mins × 60 secs
= 28800 seconds

Change to km
÷ by 1000 = 10^3

2) A tank which holds 100 litres of water has a leak.

After 150 minutes, there is no water left in the tank.



The above graph represents the volume of water (v litres) against time (t minutes).

(a) Find the equation of the line in terms of v and t.

(b) How many minutes does it take for the container to lose 30 litres of water?

Sol^{n}

(a) The equation of a line is $y = mx + c$

gradient $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

(0, 100)
(150, 0)

$= \dfrac{0 - 100}{150 - 0}$

$= \dfrac{-100}{150}$

÷ by 50 (top and bottom)

$= \dfrac{-2}{3}$

y intercept (0, 100)

$c = 100$

$y = mx + c$ (from graph above $y = v$ and $x = t$)

$v = mt + c \longrightarrow v = mt + c$

$v = \dfrac{-2}{3} t + 100$

(b)

litres		minutes	
	100	150	
÷ 100			÷ 100
	1	1.5	
× 30			× 30
	30	45	

It takes 45 minutes for the container to lose 30 litres of water

3) Bottles of juice should contain 50 millilitres.
The contents of 7 bottles are checked in a random sample.
The actual volumes in millilitres are as shown below.

52, 50, 51, 49, 52, 53, 50

Calculate the mean and standard deviation of the sample.

Sol^{n}

Mean $\dfrac{\Sigma x}{n} = \dfrac{52 + 50 + 51 + 49 + 52 + 53 + 50}{7}$

$= \dfrac{357}{7}$

Mean $= 51$

Standard Deviation

$$\sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{(n-1)}}$$

$\sum x^2 = 52^2 + 50^2 + 51^2 + 49^2 + 52^2 + 53^2 + 50^2$

$\sum x^2 = 18219$

$\sum x = 357$

$(\sum x)^2 = (357)^2$

$(\sum x)^2 = 127449$

$n = 7$

$(n - 1) = 6$

$$= \sqrt{\frac{18219 - (127449 / 7)}{6}}$$

$$= \sqrt{\frac{12}{6}}$$

$= \sqrt{2}$

Standard Deviation = 1.41 (2 d.p.)

4) 250 milligrams of a drug are given to a patient at 12 noon.
The amount of the drug in the bloodstream decreases by 20% every hour.
How many milligrams of the drug are in the bloodstream at 3pm.

Sol^{n}

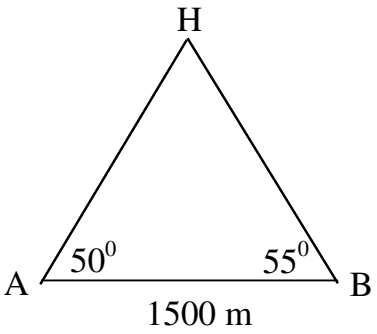
12 noon	250
1pm	250×0.8
2pm	$250 \times 0.8 \times 0.8$
	$= 250 \times (0.8)^2$
3pm	$250 \times 0.8 \times 0.8 \times 0.8$
	$= 250 \times (0.8)^3$
	$=$ 128 milligrams

↓ losing 20% each hour

left with 80%
of the previous hour

$80\% = \frac{80}{100} = 0.8$

5) A helicopter, at point H, hovers between two aircraft carriers at points A and B which are 1500 metres apart.

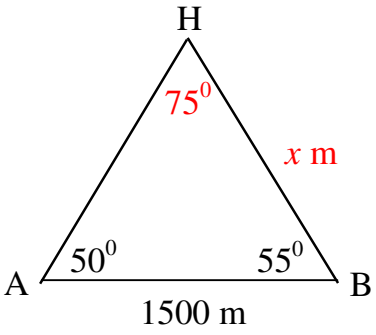


From carrier A, the angle of elevation of the helicopter is 50^0.

From carrier B, the angle of elevation of the helicopter is 55^0.

Calculate the distance from the helicopter to the nearest carrier.

Sol^n



Shortest side is opposite the smallest angle

Sine Rule

$$\frac{x}{\sin 50} = \frac{1500}{\sin 75}$$

$(x)(\sin 75) = (1500)(\sin 50)$

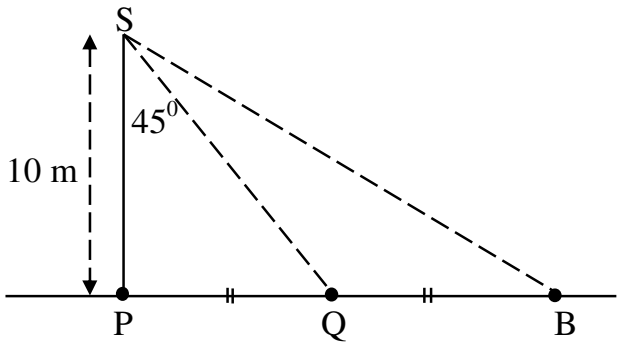
$(\div \sin 75$ both sides $)$

$$x = \frac{(1500)(\sin 50)}{(\sin 75)}$$

$x = 1189.6$ m (1 d.p.) The distance to the nearest carrier is 1189.6 metres.

6) The diagram below shows a spotlight at point S, mounted 10 metres directly above a point P at the front edge of a stage.

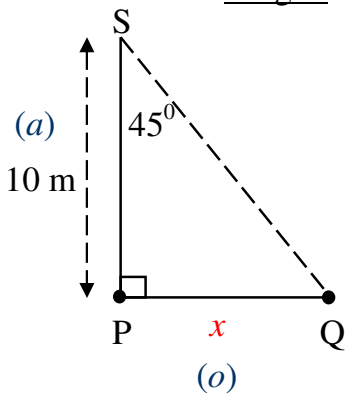
The spotlight swings 45^0 from the vertical to illuminate another point Q, also at the front point of the stage.



Through how many **more** degrees must the spotlight swing to illuminate a point B, where Q is the mid-point of PB?

Sol^n

Diag. 1



$\tan 45^0 = \frac{o}{a} = \frac{x}{10}$

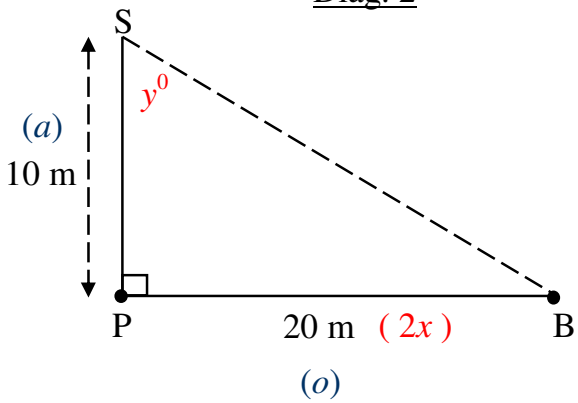
$\tan 45^0 = \frac{x}{10}$

($\times 10$ both sides)

$(10)(\tan 45^0) = x$

$\underline{x = 10}$

Diag. 2



$\tan y^0 = \frac{o}{a} = \frac{20}{10}$

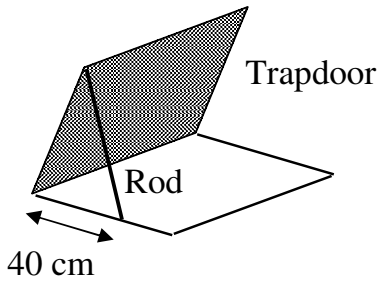
$\tan y^0 = \frac{20}{10}$

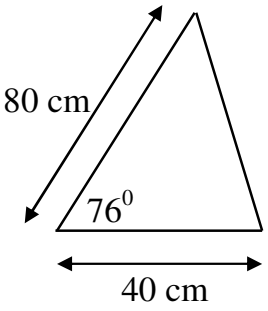
$\tan y^0 = 2$

$\underline{y^0 = 63.4^0}$

Spotlight must swing through $63.4^0 - 45^0 = \underline{\underline{18.4^0}}$ **more** to illuminate a point at B.

7) A square trapdoor of side 80 centimetres is held open by a rod as shown.



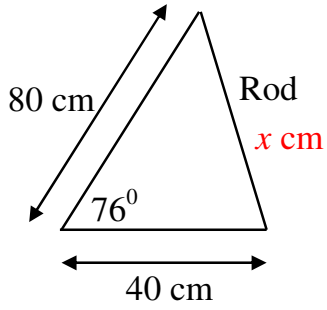


The rod is attached to a corner of the trapdoor and placed 40 centimetres along the edge of the opening.

The angle between the trapdoor and the opening is 76^0.

Calculate the length of the rod to **2 significant figures**.

Sol^n



Cosine Rule

$x^2 = 80^2 + 40^2 - (2)(80)(40)(\cos 76^0)$

$x^2 = 8000 - (6400)(\cos 76^0)$

$x^2 = 6451.699\ldots\ldots$

$x = \sqrt{6451.699\ldots\ldots}$

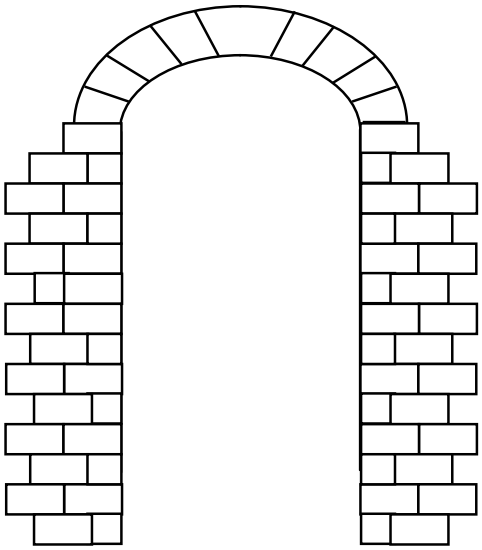
$x = 80.322\ldots\ldots$

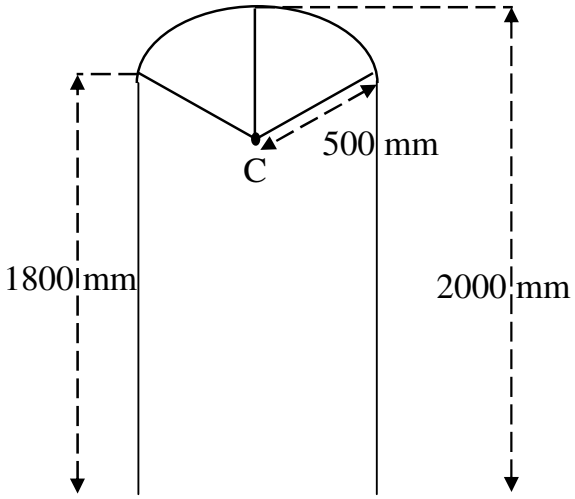
$\underline{\underline{x = 80}}$ (2 s.f.)

8) The curved part of a doorway is an artic circle with radius 500 millimetres and centre C.

The height of the doorway to the top of the arc is 2000 millimetres.

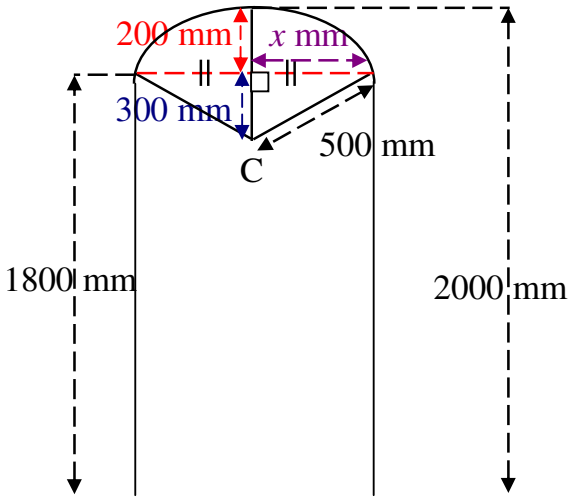
The vertical edge of the doorway is 1800 millimetres.

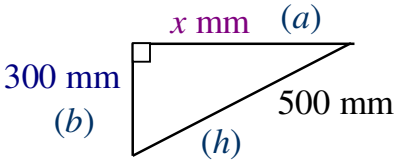




Calculate the width of the doorway.

Sol^{n}



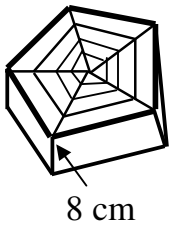


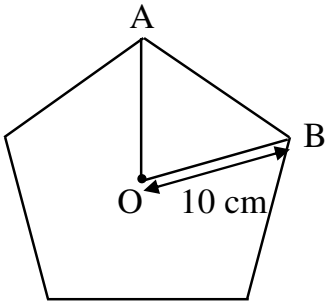
Pythagoras

$a^2 = h^2 - b^2$
$x^2 = 500^2 - 300^2$
$x^2 = 250000 - 90000$
$x^2 = 160000$
$x = \sqrt{160000}$
$x = 400$ mm

The width of the doorway is $2x$ mm $=$ (2)(400) mm $=$ 800 mm

9) A gift box, 8 centimetres high, is prism shaped.



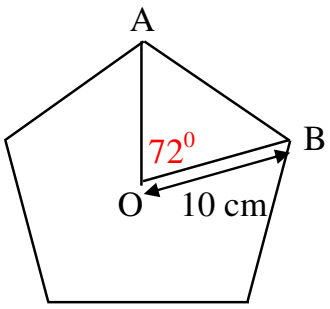


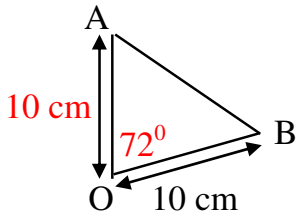
The uniform cross-section is a regular pentagon.

Each vertex of the pentagon is 10 centimetres from the centre O.

Calculate the volume of the box.

Sol^{n}





$\frac{360^0}{5} = 72^0$

Area of $\triangle AOB$

$= \frac{1}{2} \times 10 \times 10 \times \sin 72^0$

$= \underline{47.55\ cm^2}$ (2 d.p.)

Area of Pentagon $= 5 \times 47.55$

$= \underline{237.75\ cm^2}$

Volume of the box = Area of Pentagon $\times$ Height of Box

$= 237.75\ cm^2 \times 8\ cm$

$= \underline{1902\ cm^3}$

10) Solve **algebraically** the equation

$$4 \sin x^o + 1 = -2 \qquad 0 \le x \le 360.$$

Sol^n

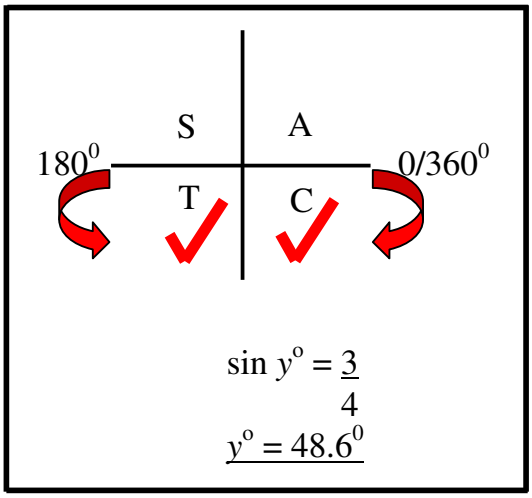
$4 \sin x^o + 1 = -2$

(-1 both sides)

$4 \sin x^o = -3$

($\div 4$ both sides)

$$\sin x^o = \frac{-3}{4}$$



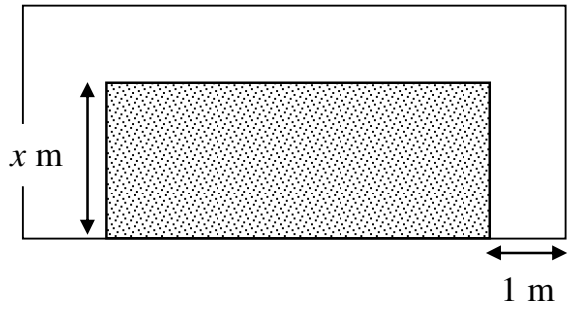
$$\sin y^o = \frac{3}{4}$$

$y^o = 48.6^0$

$x^o = (180 + 48.6)^0$ or $x^o = (360 - 48.6)^0$

$x^o = 228.6^0$ or $x^o = 311.4^0$

11) A rectangular lawn has a path, 1 metre wide, on 3 sides as shown.



The breadth of the lawn is x metres.

The length of the lawn is three times its breadth.

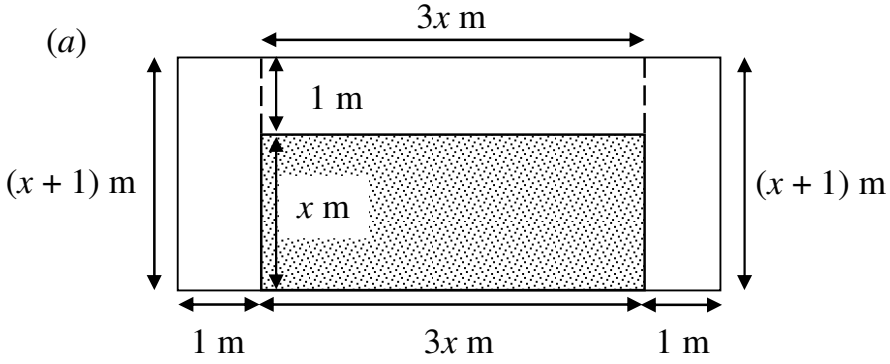
The area of the lawn equals the area of the path.

(*a*) Show that $3x^2 - 5x - 2 = 0$.

(*b*) Hence find the **length** of the lawn.

Sol^n

(*a*)



Area of Lawn = $(3x)(x)$ = $3x^2$

Area of Path = $2(1)(x + 1) + (3x)(1)$ = $2(x + 1) + 3x$ = $2x + 2 + 3x$ = $5x + 2$

Area of lawn = Area of path

$3x^2 = 5x + 2$

$3x^2 - 5x - 2 = 0$

(*b*) $3x^2 - 5x - 2 = 0$

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

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

$3x = -1$ or $\underline{\underline{x = 2}}$

$x = \underline{\underline{-1}}$
$\quad\quad 3$

(NOT possible
x is a length)

The **length** of the garden is $3x = (3)(2)$

$= \underline{\underline{6 \text{ metres}}}$

2005 CREDIT PAPER 1 SOLUTIONS

1. $3.8 - (7.36 \div 8)$

$= 3.8 - 0.92$

$= \underline{2.88}$

$$8\overline{)7.36} = 0.92$$

$$\begin{array}{r} {}^{2}\cancel{3}.{}^{17}\cancel{8}{}^{1}0 \\ -\ 0.92 \\ \hline 2.88 \end{array}$$

2. $2\frac{1}{3} + \frac{5}{6}$ of $1\frac{2}{5}$

$= \frac{7}{3} + \frac{5}{6} \times \frac{7}{5}$

$= \frac{7}{3} + \frac{7}{6}$

$= \frac{14}{6} + \frac{7}{6}$

$= \frac{21}{6}$

$= \underline{\frac{7}{2}}$

3. 50% of £140 = £70

25% of £140 = £35

12.5% of £140 = £17.50

or $12.5\% = \frac{1}{8}$

$\Rightarrow$ £70 ÷ 8 = £17.50

or £70 ÷ 100 × 12.5

= £17.50 etc.

4. Totals of 8 or 9 required, ignoring duplicates

(2,6) (3,5) (3,6) (4,4) (4,5)

1 1	2 2	3 3	4 4	5 5	6 6
1 2	2 3	3 4	4 5	5 6	
1 3	2 4	3 5	4 6		
1 4	2 5	3 6			
1 5	2 6				
1 6					

$$P(7 < x < 10) = \frac{5}{21}$$

5. For gradient, pick any two points from table.

eg. (0,6) (1,4)

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

y-intercept = 6 (0,6)

$$m = \frac{4 - 6}{1 - 0} \Rightarrow y = -2x + 6$$

$$m = \frac{-2}{1}$$

$$m = -2$$

6. $\frac{2}{x} + 1 = 6$

$\frac{2}{x} = 5$

$2 = 5x$

$\frac{2}{5} = x$

7.

SPEED (km/hr)	FREQUENCY	CUMULATIVE FREQUENCY
30	1	1
40	4	5
50	9	14
60	14	28
70	38	66
80	47	113
90	51	164
100	32	196
110	4	200

Median = 80 km/h

8. a) 4th term: $5^2 - 3^2$

b) nth term: $(n+1)^2 - (n-1)^2$

$= n^2 + 2n + 1 - (n^2 - 2n + 1)$

$= n^2 + 2n + 1 - n^2 + 2n - 1$

$= 4n$

9. a) £30 ÷ £0.75 = 40 litres

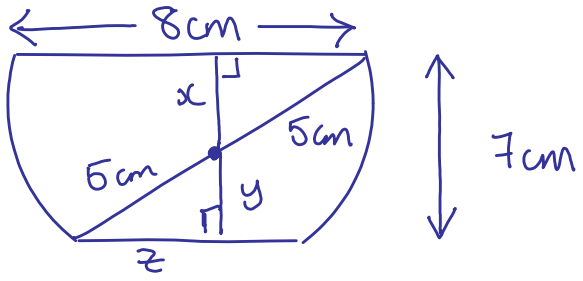
Fuel remaining = 40 − 5×3

= 25 litres

b) Total litres = $\frac{20}{C}$

$\Rightarrow R = \frac{20}{C} - kt$

10.



$x^2 = 5^2 - 4^2$

$x^2 = 9$

$x = 3\text{cm}$

$z^2 = 5^2 - 4^2$

$z^2 = 9$

$z = 3\text{ cm}$

$\Rightarrow y = 4\text{cm}$

$\Rightarrow$ Length of base = 6 cm

11. a) $f(x) = 4\sqrt{x} + \sqrt{2}$

$f(72) = 4\sqrt{72} + \sqrt{2}$

$= 4\sqrt{36 \times 2} + \sqrt{2}$

$= 4 . 6\sqrt{2} + \sqrt{2}$

$= 24\sqrt{2} + \sqrt{2}$

$= \underline{25\sqrt{2}}$

b) $4\sqrt{t} + \sqrt{2} = 3\sqrt{2}$

$4\sqrt{t} = 2\sqrt{2}$

$\sqrt{t} = \frac{1}{2}\sqrt{2}$

(square both sides) $t = \frac{1}{4} . 2$

$t = \frac{1}{2}$

12. $A = \frac{1}{2} b h$

$7 = \frac{1}{2} . 2x . (2x - 5)$

$7 = 2x^2 - 5x$

$0 = 2x^2 - 5x - 7$

$0 = (2x - 7)(x + 1)$

$\Rightarrow$ either $2x - 7 = 0$ or $x + 1 = 0$

$2x = 7$ $x = -1$

$x = \frac{7}{2}$ discard this solution as negative length

$\Rightarrow x = \frac{7}{2}$ cm

2005 CREDIT PAPER 2 SOLUTIONS

1. $E = 3.6 \times 10^{-2} \times (3 \times 10^{8})^{2}$

$E = 3.6 \times 10^{-2} \times 9 \times 10^{16}$

$E = 32.4 \times 10^{14}$

$E = 3.24 \times 10^{15}$

2. $\bar{x} = \frac{477}{6}$

$\bar{x} = 79.5$

x	$x - \bar{x}$	$(x-\bar{x})^2$
71	-8.5	72.25
75	-4.5	20.25
77	-2.5	6.25
79	-0.5	0.25
84	4.5	20.25
91	11.5	132.25
$\Sigma x = 477$	$\Sigma(x-\bar{x})^2 =$	251.25

$s = \sqrt{\frac{251.25}{5}}$

$s = 7.09$

Mean = 79.5 min Standard Deviation = 7.09 min

3. $\text{Area} = \frac{1}{2}qr\sin P$

$= \frac{1}{2}(19)(21)\sin 110°$

$= 187.5\ cm^2$

4. $x^2 + 2x = 9$

$x^2 + 2x - 9 = 0$

$a = 1 \quad b = 2 \quad c = -9$

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

$$x = \frac{-(2) \pm \sqrt{(2)^2 - 4(1)(-9)}}{2(1)}$$

$$x = \frac{-2 \pm \sqrt{(4 + 36)}}{2}$$

$$x = \frac{-2 + \sqrt{40}}{2} \quad \text{or} \quad x = \frac{-2 - \sqrt{40}}{2}$$

$x = 2.2$ $\qquad$ $x = -4.2$

5. $(110)^2 = (90)^2 + (60)^2$

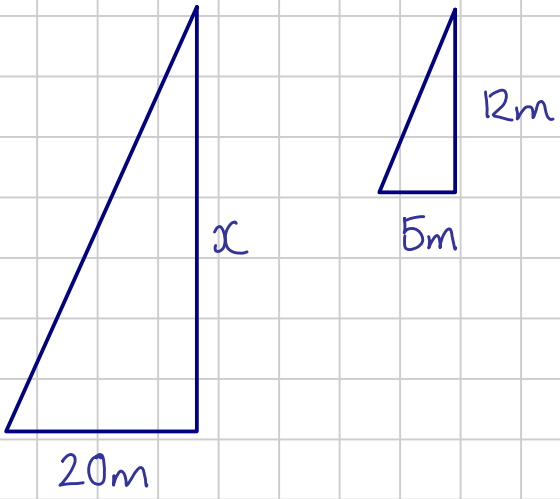
$12100 = 8100 + 3600$

$12100 = 11700$

LHS $\neq$ RHS

$\Rightarrow$ Not a right angled triangle

6.



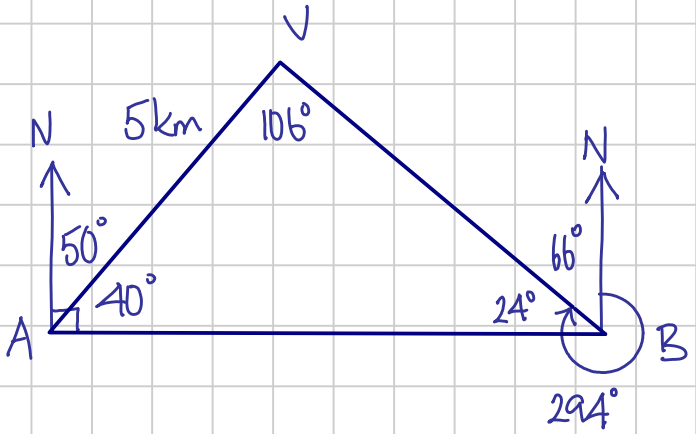
Triangles are similar.

$$\frac{x}{20} = \frac{12}{5}$$

$$x = \frac{240}{5}$$

$$x = 48\,m$$

7.



Add angles to diagram

$$\frac{a}{\sin A} = \frac{5}{\sin B} = \frac{(V)}{\sin V}$$

$$\frac{AB}{\sin 110^\circ} = \frac{5}{\sin 4^\circ}$$

$$AB = \frac{5 \sin 110^\circ}{\sin 24^\circ}$$

$$AB = 11.6 \text{ km}$$

8.

$$(2x)^3 = 6(2x)^2$$

$$8x^3 = 6 \cdot 4x^2$$

$$8x^3 = 24x^2$$

$$8x^3 - 24x^2 = 0$$

$$8x^2(x-3) = 0$$

either $8x^2 = 0$ or $x - 3 = 0$

$x = 0$ $x = 3$

discard as zero length $\Rightarrow$ $2x = 6$

Side length = 6 cm

9. a) Fixed rental = £10

b) Charge per minute = gradient of line.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$(0, 10)$ $(60, 13)$
x_1, y_1 x_2 y_2

$$m = \frac{13 - 10}{60 - 0}$$

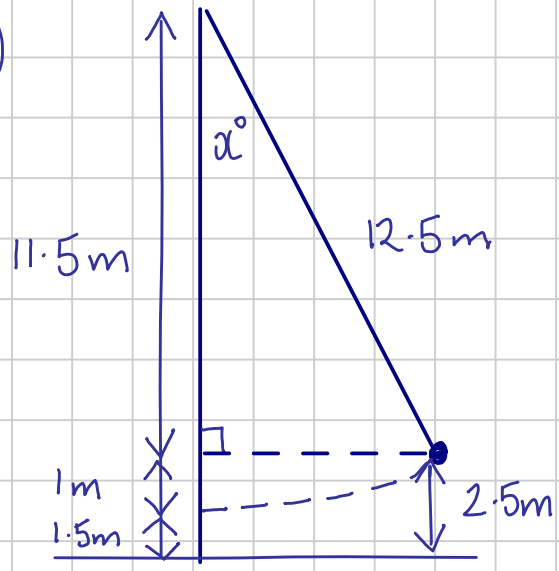
$$m = \frac{3}{60}$$

$$m = \frac{1}{20}$$

ie. $\frac{1}{20}$ of £1 = 5p

$\Rightarrow$ Call charge = 5p/min

10. a)



$$\cos x^\circ = \frac{\text{adj}}{\text{hyp}}$$

$$\cos x^\circ = \frac{11.5}{12.5}$$

$$x^\circ = \cos^{-1}\left(\frac{11.5}{12.5}\right)$$

$$x^\circ = 23^\circ$$

b) $\frac{\text{Arc Length}}{25\pi} = \frac{46^\circ}{360^\circ}$

$d = 12.5 \times 2$

$d = 25\,m$

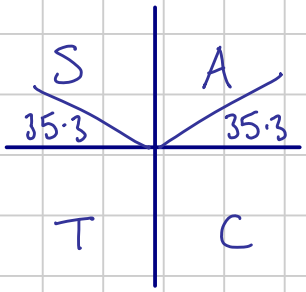
$\text{Arc Length} = \frac{46^\circ}{360^\circ} \times 25\pi$

$\text{Arc Length} = 10.0\,m$ (to 3 s.f.)

11 a) $\sqrt{3}\sin x^\circ - 1 = 0$

$\sqrt{3}\sin x^\circ = 1$

$\sin x^\circ = \frac{1}{\sqrt{3}}$



$x^\circ = 35.3^\circ, 144.7^\circ$

b) $2x^\circ = 35.3^\circ$

$x^\circ = 17.6^\circ$

CREDIT 2006 PAPER 1 SOLUTIONS

1. $56.4 - 1.25 \times 40$

BODMAS: multiply first

$= 56.4 - 50$

$= 6.4$

1.25
$\times\ 40$
50.00

2. $1\frac{3}{5} + 2\frac{4}{7}$ OR $1\frac{3}{5} + 2\frac{4}{7}$

$= \frac{8}{5} + \frac{18}{7}$ $= 3\frac{3}{5} + \frac{4}{7}$

$= \frac{56}{35} + \frac{90}{35}$ $= 3\frac{21}{35} + \frac{20}{35}$

$= \frac{146}{35}$ * $= 3\frac{41}{35}$

$= 4\frac{6}{35}$ * $= 4\frac{6}{35}$

* Either a vulgar fraction or mixed numbers should be acceptable

3. $f(x) = 4 - x^2$

$f(-3) = 4 - (-3)^2$ Remember, $(-3)^2 = 9$

$= 4 - 9$

$= -5$

4. From the graph we have two points: $(0, 8)$ and $(6, 12)$.

$x_1\ y_1$ $x_2\ y_2$

$m = \frac{y_2 - y_1}{x_2 - x_1}$ $c = 8$

$m = \frac{12 - 8}{6 - 0}$ $\Rightarrow$ $y = \frac{2}{3}x + 8$

$m = \frac{4}{6}$

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

5. (a) $4x^2 - y^2$ Difference of two squares

$= (2x + y)(2x - y)$

(b) $\dfrac{4x^2 - y^2}{6x + 3y}$

$= \dfrac{(2x+y)^{1}(2x-y)}{3(2x+y)^{1}}$ Cancel $(2x+y)$

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

6. $x - 2(x+1) = 8$

$x - 2x - 2 = 8$ Remember to multiply $+1$ by -2 as well.

$-x - 2 = 8$

$-x = 10$

$x = -10$

7. Enlargement factor (height) $= \dfrac{21}{14}$

$= \dfrac{3}{2}$

Enlargement factor (volume) $= \left(\dfrac{3}{2}\right)^3$ Remember to cube scale factor for volume

$= \dfrac{27}{8}$

Volume of large cup $= \dfrac{27}{8} \times 160\,ml$

$= 27 \times 20\,ml$

$= 540\,ml$

8. Example: $y = (x-2)^2 + 3$ — Minimum turning point at $(2,3)$

(2 right, 3 up)

$\Rightarrow$ For minimum turning point at $(1,-4)$:

$$y = (x-1)^2 - 4$$

9. (a) $x + y = 20$

(b) $5x + 2y = 79$

(c) $x + y = 20$ ①

$5x + 2y = 79$ ②

$5x + 2y = 79$ ②

$-\ 2x + 2y = 40$ ① × 2

$3x = 39$

$x = 13$

check: when $x = 13$, $y = 7$

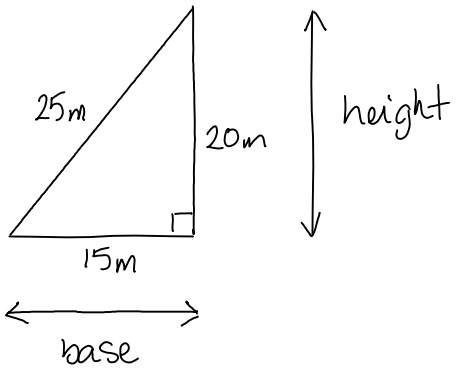
$5(13) + 2(7) = 65 + 14$

$= £79$

$=$ RHS

Evan wins 13 games

10. (a)



Rotate triangle to make either 15m or 20m the base.

$A = \frac{1}{2}bh$

$A = \frac{1}{2} . 15 . 20$

$A = 150m^2$

(b) $A = \frac{1}{2}bh$

$150 = \frac{1}{2} . 25 . h$

$300 = 25h$

$\frac{300}{25} = h$

$h = 12m$

11. (a) £ $3x$

(b) (i) Cost of 15 sessions $= £20 + 9 \times £3$

$= £20 + £27$

$= £47$

(ii) $C = 20 + 2(x - 6)$

↑ cost of card

↑ number of paid sessions equals total sessions − 6

(c) To be more economic, the cost of x sessions using the card must be less the cost without a card.

$$\begin{aligned} 20 + 2(x - 6) &< 3x \\ 20 + 2x - 12 &< 3x \\ 2x + 8 &< 3x \\ 8 &< x \\ x &> 8 \end{aligned}$$

Check for $x = 8$

Cost without card $= £24$

Cost with card $= 20 + 2(8 - 6)$

$= £24$

$\Rightarrow$ Card option is cheaper for a minimum of 9 sessions.

CREDIT 2006 PAPER 2 SOLUTIONS

1. $C = \pi d$

$C = \pi \times 2 \times 4.96 \times 10^7$

$C = 311\,645\,991.2$ km

$C = 3.12 \times 10^8$ km

Remember to double the radius.

2. (a) Mean, $\bar{x} = \frac{459}{6}$

$\bar{x} = 76.5$ beats per minute

x	$x - \bar{x}$	$(x - \bar{x})^2$
68	−8.5	72.25
73	−3.5	12.25
86	9.5	90.25
72	−4.5	20.25
82	5.5	30.25
78	1.5	2.25

$\Sigma x = 459 \quad \Sigma (x - \bar{x})^2 = 227.5$

$s = \sqrt{\frac{\Sigma (x - \bar{x})^2}{n - 1}}$

$s = \sqrt{\frac{227.5}{5}}$

$s = \sqrt{45.5}$

$s = 6.7$

(b) On average, the children have a higher pulse rate than the adults.

The adult pulse rates measured have a wider spread.

3. $108\% = £324$

$1\% = \frac{£324}{108}$

$100\% = \frac{£324}{108} \times 100$

Original value will be 100%
After tax this will become 108%
Find 1% to calculate 100%

$\Rightarrow$ Bid price was £300

4 (a) $(x+4)(3x-1)$

$= x(3x-1) + 4(3x-1)$

$= 3x^2 - x + 12x - 4$

$= 3x^2 + 11x - 4$

or. $(x+4)(3x-1)$ FOIL

$= 3x^2 - x + 12x - 4$

$= 3x^2 + 11x - 4$

(b) $m^{\frac{1}{2}}(2 + m^2)$

$= 2m^{\frac{1}{2}} + m^{\frac{5}{2}}$

Add powers when multiplying

(c) $2\sqrt{20} - 3\sqrt{5}$

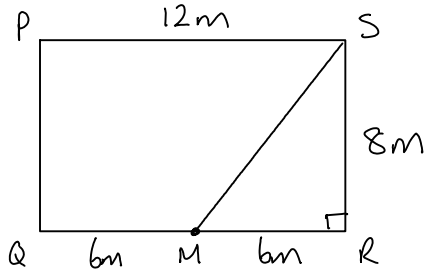
$= 2\sqrt{4 \times 5} - 3\sqrt{5}$

$= 2 \times 2\sqrt{5} - 3\sqrt{5}$

$= 4\sqrt{5} - 3\sqrt{5}$

$= \sqrt{5}$

5.



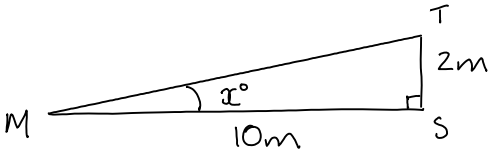
$MS^2 = 8^2 + 6^2$

$MS^2 = 64 + 36$

$MS^2 = 100$

$MS = \sqrt{100}$

$MS = 10m$



SOH ✓ CAH ✓ TOA ✓

$\tan x^\circ = \frac{opp}{hyp}$

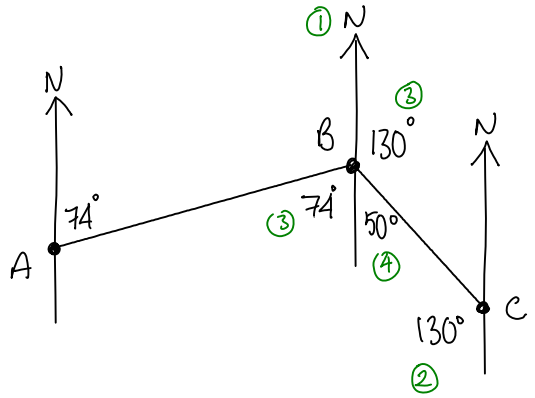
$\tan x^\circ = \frac{2}{10}$

$x^\circ = \tan^{-1}\left(\frac{2}{10}\right)$

$x^\circ = 11.3^\circ$

Angle TMS = 11.3°

6. (a)



① Draw a north line at B

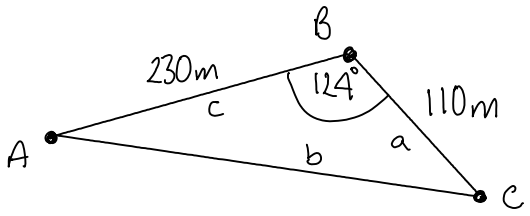
② $310° - 180° = 130°$

③ Alternate angles

④ $180° - 130° = 50°$

Angle $ABC = 124°$

(b)



Use 3 sides & 1 angle ⇒ Cosine rule

$$b^2 = a^2 + c^2 - 2ac\cos B$$

$$b^2 = (110)^2 + (230)^2 - 2(110)(230)\cos 124°$$

$$b^2 = 93295.16$$

$$b = \sqrt{93295.16}$$

$$b = 305.44m$$

$\Rightarrow$ AC = 305 m to 3 s.f.

7 (a) $V = Ah$

$V = 28 \times 18$

$V = 504\ cm^3$

(b) $V = \pi r^2 h$

$504 = \pi(0.7)^2 h$

$504 = 0.49\pi h$

$\frac{504}{0.49\pi} = h$

$h = 327.4\ cm$

$\Rightarrow$ Cable length = 327.4 cm

8. Arc length $= \frac{x^\circ}{360^\circ} \times \pi d$

$= \frac{284^\circ}{360} \times \pi \times 18$

$= 44.6$ cm

$\frac{44.6}{2} = 22.3$ (100g per 2cm)

Weight of parcel $= 22.3 \times 100g$

$= 2230\,g$

$= 2.23\,kg$

9 (a) $d = \frac{1}{2}.7(7-3)$

$d = \frac{1}{2}.7.4$

$d = 14$

A polygon of 7 sides has 14 diagonals

(b) $\frac{1}{2}n(n-3) = 65$

$n(n-3) = 130$

$n^2 - 3n = 130$

$n^2 - 3n - 130 = 0$

(c) $n^2 - 3n - 130 = 0$ Look for factors of 130 with a difference of 3.

$(n+10)(n-13) = 0$

either $n+10 = 0$ or $n-13 = 0$

$n = -10$ $n = 13$

Discard $n=-10$ as cannot have negative number of sides.

The polygon has 13 sides.

10. (a) when $t = 20$,

$$h = -31\cos 20^\circ + 33$$
$$h = 3.87\text{ m}$$

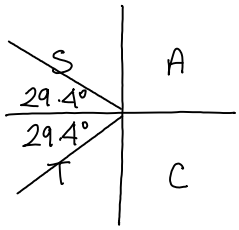
Emma is 3.87 m above the ground after 20 seconds.

(b) when $h = 60$,

$$-31\cos t^\circ + 33 = 60$$
$$-31\cos t^\circ = 27$$
$$\cos t^\circ = -\frac{27}{31}$$

Acute angle, $t^\circ = \cos^{-1}\left(\frac{27}{31}\right)$

$(t^\circ = 29.4^\circ)$



$180 - 29.4^\circ = 150.6^\circ$

$180 + 29.4^\circ = 209.4^\circ$

$\Rightarrow t^\circ = 150.6^\circ, 209.4^\circ$

$\Rightarrow$ Emma will first reach a height of 60m 150.6 seconds from the start.

(c) She will next be at a height of 60m above ground 209.4 seconds after the start.

11. (a) $AQ = AM + MQ$

$AQ = (3 + x)$ cm

(b) Reduction Factor $= \frac{3+x}{6}$

$$PQ = \frac{1}{6}(3+x) \times 8$$
$$= \frac{8}{6}.3 + \frac{8}{6}x$$
$$= \frac{24}{6} + \frac{4}{3}x$$
$$\Rightarrow PQ = \left(4 + \frac{4}{3}x\right)\text{ cm}$$

Credit Level

2007 Paper 1

1. $6.04 + 3.72 \times 20$

$= 6.04 + 74.4$

$= \underline{80.44}$

BODMAS 3.72×20

$= 3.72 \times 10 \times 2$

$= 37.2 \times 2$

$= 74.4$

2. $3\frac{1}{6} \div 1\frac{2}{3}$

$= \frac{19}{6} \div \frac{5}{3}$

$= \frac{19}{6} \times \frac{3}{5}$

$= \frac{57}{30}$

$= \frac{19}{10}$

$= \underline{1\frac{9}{10}}$

3. $\frac{5}{8}$ of 400

$= 400 \div 8 \times 5$

$= 50 \times 5$

$= \underline{250 \text{ males}}$.

4. $P = \frac{2(m-4)}{3}$

$(\times 3)\ 3P = 2(m-4)$

$(\div 2)\ \frac{3P}{2} = m - 4$

$(+4)\ \underline{m = \frac{3P}{2} + 4}$

5. $(2x+3)^2 - 3(x^2-6)$

$= (2x+3)(2x+3) - 3x^2 + 18$

$= 4x^2 + 6x + 6x + 9 - 3x^2 + 18$

$= \underline{x^2 + 12x + 27}$

6. Using points $(0, 2)$ and $(5, 6)$

(x_1, y_1) (x_2, y_2)

$m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad c = 2$

$= \frac{6-2}{5-0}$

$= \frac{4}{5}$

So, $y = \frac{4}{5}x + 2$

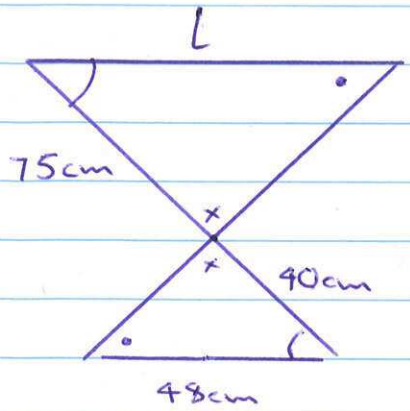
$\Rightarrow \underline{f = \frac{4}{5}d + 2}$

7. $a^{\frac{1}{2}}(a^{\frac{1}{2}} - 2)$

$= a^1 - 2a^{\frac{1}{2}}$

$= \underline{a - 2a^{\frac{1}{2}}}$

8.



∴ Similar Triangles

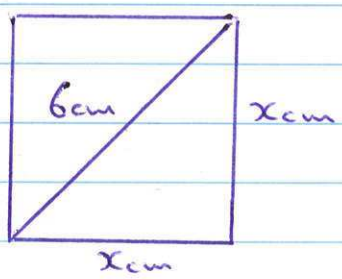
Scale Factor (length) $= \frac{75}{40}$

$= \frac{15}{8}$

So, $L = \frac{15}{8} \times 48$

$= \underline{90\text{ cm}}$

9.



By Pythagoras

$c^2 = a^2 + b^2$

$6^2 = x^2 + x^2$

$36 = 2x^2$

$(\div 2)\quad x^2 = 18$

$(\sqrt{\ })\quad x = \sqrt{18}$

$= \sqrt{9 \times 2}$

$= \underline{3\sqrt{2}}$

10. $T = \frac{k}{L^3}$

When L is doubled, $T = \frac{k}{(2L)^3}$

$= \frac{k}{8L^3}$

$= \frac{1}{8} \times \frac{k}{L^3}$

$\Rightarrow$ T is 8 times smaller.

11. (a) $x + y = 300$

(b) $4x + 6y = 1380$

(c) $x + y = 300$ ①
$4x + 6y = 1380$ ②

① × 4 $\quad 4x + 4y = 1200$

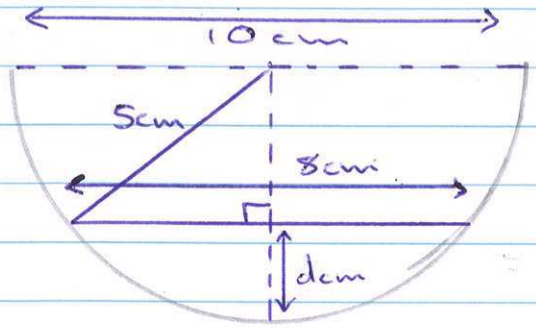
② − ① $\quad 2y = 180$
(÷2) $\quad y = 90$

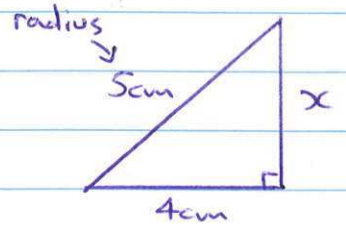
Subst $y = 90$ in ①

$x + y = 300$
$x + 90 = 300$
(−90) $\quad x = 210$

Sol^n is 210 standard seats and 90 deluxe seats

12.





By Pythagoras

$a^2 = c^2 - b^2$

$x^2 = 5^2 - 4^2$

$= 25 - 16$

$= 9$

$(\sqrt{\ }) \quad x = 3 \text{ cm}$

Therefore $d = 5 - 3$

$= 2 \text{ cm}$.

13. Two waves in $360^\circ \Rightarrow b = 2$

Maximum = 4
Minimum = 2
} moved up 3 $\Rightarrow$ $c = 3$

Therefore $y = \cos 2x + 3$

14. (a) $S_n = 3^n - 1$

$\therefore S_2 = 3^2 - 1$

$= 9 - 1$

$= \underline{\underline{8}}$

(b) $S_n = 80$

$\Rightarrow 3^n - 1 = 80$

$(+1)\quad 3^n = 81$

$\quad 3^4 = 81$

$\Rightarrow \underline{\underline{n = 4}}$

Credit Level

2007 Paper 2

1. Value = £600 × 1.045^3

= £684.70

2. $3x^2 - 2x - 10 = 0$

$a=3 \quad b=-2 \quad c=-10$

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

$b^2 - 4ac$

$= (-2)^2 - 4(3)(-10)$

$= 4 - (-120)$

$= 124$

$$= \frac{-(-2) \pm \sqrt{124}}{2(3)}$$

$$= \frac{2 \pm \sqrt{124}}{6}$$

$$= \frac{2 + \sqrt{124}}{6} \quad \text{or} \quad \frac{2 - \sqrt{124}}{6}$$

$= 2.189...$ or $-1.522..$

$= 2.2$ or -1.5 (2 sig fig)

3. (a)

x	$x - \bar{x}$	$(x - \bar{x})^2$
28	4	16
32	8	64
14	-10	100
19	-5	25
18	-6	36
26	2	4
31	7	49

$\sum x = 168$ $\qquad$ $\sum (x - \bar{x})^2 = 294$

$\bar{x} = \frac{168}{7}$

$= 24$

So, $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$

$= \sqrt{\frac{294}{6}}$

$= \sqrt{49}$

$= 7$

(b) • on average, move birds visit Erin's table
• the number of birds visiting Luke's table varies more

4. $x/4 - 1/2 < 5$

$(\times 4)$ $x - 2 < 20$

$(+2)$ $x < 22$

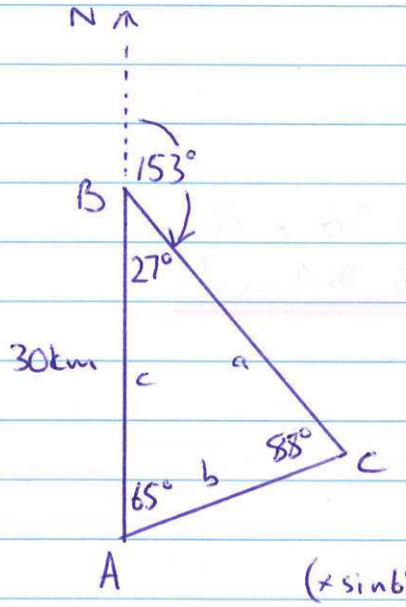
5. $110\% = £148.50$

$(\div 110)$ $1\% = £1.35$

$(\times 100)$ $100\% = £135$

Therefore the meal cost £135

6.



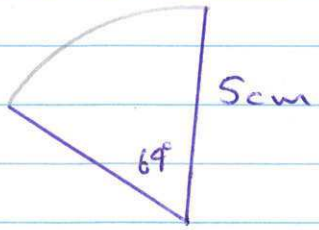
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{\sin A} = \frac{c}{\sin C}$$

$$\frac{BC}{\sin 65} = \frac{30}{\sin 88}$$

$(\times \sin 65)$ $$BC = \frac{30 \sin 65}{\sin 88}$$

$$= 27.2 \text{ km}$$

7. 

$$\frac{\text{Area of Sector}}{\text{Area}} = \frac{x^\circ}{360^\circ}$$

$$\frac{A}{\pi r^2} = \frac{64^\circ}{360^\circ}$$

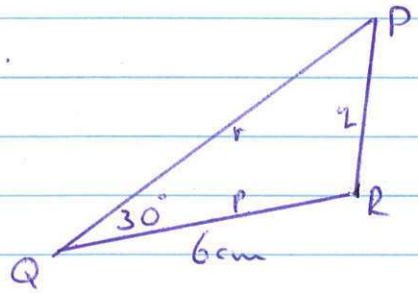
$$A = \frac{64}{360} \times \pi r^2$$

$$= \frac{64}{360} \times \pi \times 5^2$$

$$= 13.96 \text{ cm}^2$$

$\therefore$ Total area of plastic $= 13.96 \times 4$

$= \underline{55.84 \text{ cm}^2}$

8. 

Area $= 15 \text{ cm}^2$

S. $A = \frac{1}{2} pr \sin Q$

$15 = \frac{1}{2} \times 6 \times r \times \sin 30$

$= 3 \times r \times \sin 30$

$= 3r \times \frac{1}{2}$

$(\times 2)$ $30 = 3r$

$(\div 3)$ $r = 10$

$\therefore$ $\underline{PQ = 10 \text{ cm}}$

9. Copper : Gold
5 : 7

$\frac{160g}{5} = 32$ | $\frac{245g}{7} = 35$

$\Rightarrow$ maximum gold $= 32 \times 7$
$= 224g$

$\Rightarrow$ maximum weight of 14 carat gold
$= 160g + 224g$
$= \underline{384g}$

10. $5\cos x + 4 = 0$

(-4) $5\cos x = -4$

$(\div 5)$ $\cos x = -4/5$

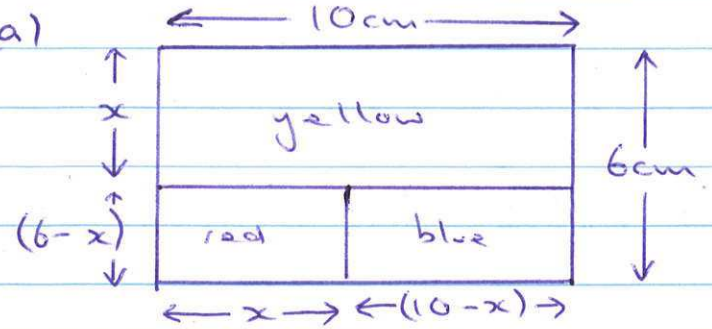
cos is negative in ✓ | ✓

Q1 angle is $x = \cos^{-1}(4/5)$
$= 36.87$

Q2 angle is $180 - 36.87 = 143.13^\circ$
Q3 angle is $180 + 36.87 = 216.87^\circ$

$\Rightarrow$ $\underline{x^\circ = 143.13^\circ \text{ and } 216.87^\circ}$

11. (a)



$A = (10-x)(6-x)$

$= 60 - 10x - 6x + x^2$

$= \underline{x^2 - 16x + 60}$

(b) Total Area $= 10 \times 6$

$= 60\text{cm}^2$

Since Blue Area $= \frac{1}{5}$ of Total Area

$= \frac{1}{5}$ of 60cm^2

$= 12\text{cm}^2$

$\Rightarrow \quad x^2 - 16x + 60 = 12$

$(-12) \quad x^2 - 16x + 48 = 0$

$(x-12)(x-4) = 0$

So, either $x = 12$ or $x = 4$

x, however, must be less than 10cm,

so, $\underline{x = 4\text{cm}}$.

12. (a) $V = \pi r^2 h$

$= \pi \times 3^2 \times 4$

$= 113.097..$

$= \underline{113.1 \text{ cm}^3}$ (1 dp)

(b) $V = \frac{2}{3}\pi r^3$

$113.1 = \frac{2}{3} \times \pi \times r^3$

$(\times 3)$ $339.3 = 2\pi r^3$

$(\div 2)$ $169.65 = \pi r^3$

$(\div \pi)$ $54.00.. = r^3$

$(\sqrt[3]{\ })$ $r = \sqrt[3]{54}$

$= \underline{3.8 \text{cm}}$ (1 dp)

13. Crosses x-axis when $y = 0$

$\Rightarrow 4x(140 - x) = 0$

$\Rightarrow$ either $x = 0$ or $x = 140$

By symmetry, maximum occurs at $x = 70$

$\Rightarrow y = 4(70)(140-70)$

$= 280 \times 70$

$= 19600$

$\Rightarrow$ <u>Maximum profit is £19600</u>.

Credit Level

2008 Paper 1

1. $24.7 - 0.63 \times 30$

$= 24.7 - 18.9$

$= \underline{5.8}$

BODMAS 0.63×30

$= 0.63 \times 10 \times 3$

$= 6.3 \times 3$

$= 18.9$

2. $5x^2 - 45$

$= 5(x^2 - 9)$

$= \underline{5(x+3)(x-3)}$

3. $W = BH^2$

$(\div B)$ $\frac{W}{B} = H^2$

$(\sqrt{\ })$ $H = \sqrt{\frac{W}{B}}$

4. Using the points $(0, 18)$ and $(9, 0)$
x_1, y_1 x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{0 - 18}{9 - 0}$

$= -\frac{18}{9}$

$= -2$

So, $\underline{y = -2x + 18}$

5. $\frac{1}{p} + \frac{2}{(p+5)}$

$= \frac{p+5}{p(p+5)} + \frac{2p}{p(p+5)}$

$= \frac{p+5+2p}{p(p+5)}$

$= \frac{3p+5}{p(p+5)}$

6(a) $D = S \times T$

$D = 2(x+8)$

(b) $D = S \times T$

$D = \frac{1}{2} \times x$

∴ 30 mins = $\frac{1}{2}$ hour

(c) $2(x+8) + \frac{1}{2}x = 46$

$2x + 16 + \frac{1}{2}x = 46$

$(\times 2)$ $4x + 32 + x = 92$

(-32) $5x = 60$

$(\div 5)$ $x = 12$

∴ Speed = 12 km/h

7 (a) 1, 6, 8

$$\text{Mean} = \frac{(1+6+8)}{3}$$

$$= \frac{15}{3}$$

$$= 5$$

$\Rightarrow$ 4th term = 5

(b) x, $(x+7)$, $(x+11)$

$$\text{Mean} = \frac{[x+(x+7)+(x+11)]}{3}$$

$$= \frac{3x+18}{3}$$

$$= x+6$$

$\Rightarrow$ 4th term = $(x+6)$

(c) $-2x$, $(x+5)$, y, $(2x+4)$

$$\Rightarrow \text{Mean} = \frac{-2x+(x+5)+y}{3} = 2x+4$$

$$(\times 3) \quad -2x+(x+5)+y = 6x+12$$

$$-x+5+y = 6x+12$$

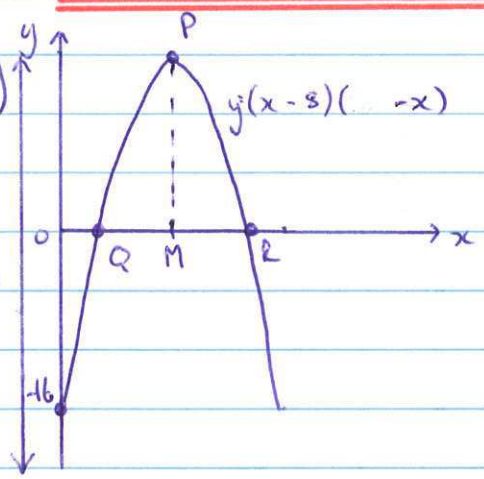
$$(+x) \quad 5+y = 7x+12$$

$$(-5) \quad y = 7x+7$$

$\Rightarrow$ 3rd term = $(7x+7)$

8. (a) $Q(2,0)$ $R(8,0)$

(b)



Let max TP = P

$M(5,0)$ when $x = 5$

$y = (5-8)(2-5)$

$= (-3)(-3)$

$= 9$

$\Rightarrow P(5,9)$

$\Rightarrow$ height, $h = 16 + 9$

$= 25$ units.

9. $m^3 \times \sqrt{m}$

$= m^3 \times m^{1/2}$ $\quad \frac{6}{2} + \frac{1}{2} = \frac{7}{2}$

$= m^{7/2}$

10. $C(0,1)$

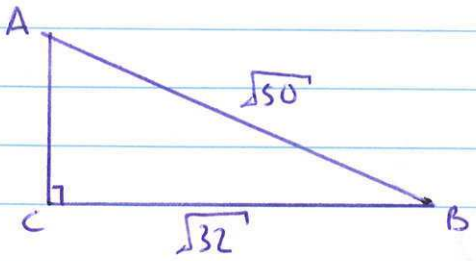
(b) When $x = 2$, $y = 16$

$y = a^x$

$16 = a^2$

$\Rightarrow a = 4$

11.



By Pythagoras

$a^2 = c^2 - b^2$

$AC^2 = (\sqrt{50})^2 - (\sqrt{32})^2$

$= 50 - 32$

$= 18$

$(\sqrt{\ }) \quad AC = \sqrt{18}$

$= \sqrt{9 \times 2}$

$= \underline{3\sqrt{2}}$

12. $x^2 - 10x + 18 = (x-a)^2 + b$

$x^2 - 10x + 18 = (x-a)(x-a) + b$

$x^2 - 10x + 18 = x^2 - 2ax + a^2 + b$

Compare coefficients:

$x^2 - 2ax + [a^2 + b]$

and $x^2 - 10x + 18$

$\Rightarrow \quad 2a = 10$

$(\div 2) \quad a = 5$

$\Rightarrow \quad a^2 + b = 18$

$5^2 + b = 18$

$25 + b = 18$

$(-25) \quad b = -7$

So, $\underline{a = 5 \text{ and } b = -7}$

13. $\frac{17+x}{24+x} = \frac{2}{3}$

$3(17+x) = 2(24+x)$

$51 + 3x = 48 + 2x$

(-51) $3x = -3 + 2x$

$(-2x)$ $x = -3$

Credit Level

2008 Paper 2

1. 42000×1.08^3

$= 52907.9$

$= \underline{52900 \text{ tonnes}}$ (3 sig figs)

2. (a) $\underline{\text{Median} = 34}$

$\underline{\text{Mode} = 29}$

(b) $P(x \geq 40) = \underline{\frac{11}{30}}$

3. $80\% = £45$

(÷8) $10\% = £5.625$

(×10) $100\% = £56.25$

$\underline{\text{So, original price was } £56.25}$

4. (a) $\underline{x + y = 60}$

(b) $\underline{50x + 20y = 1740}$

(c) $x + y = 60$ ①

$50x + 20y = 1740$ ②

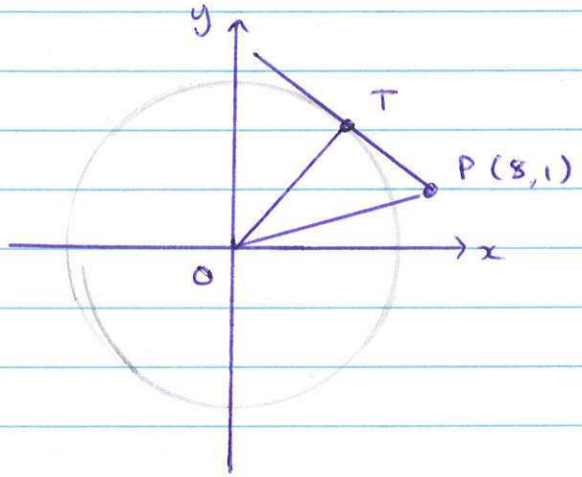
① × 20 $20x + 20y = 1200$ ③

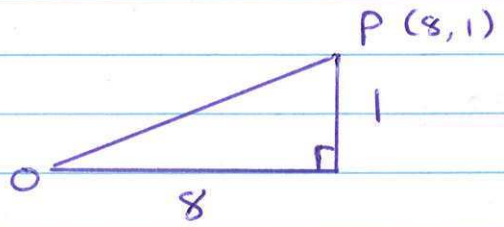
② − ③ $30x = 540$

(÷30) $x = 18$

⇒ Aaron has 18 fifty pence coins

5. (a)





By Pythagoras

$c^2 = a^2 + b^2$

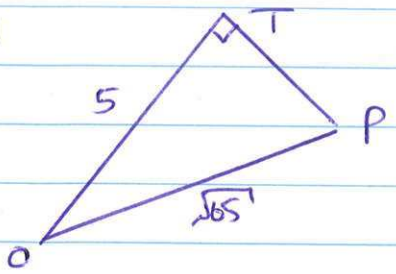
$OP^2 = 8^2 + 1^2$

$= 64 + 1$

$= 65$

$(\sqrt{\ }) \quad OP = \sqrt{65}$

(b)



By Pythagoras

$a^2 = c^2 - b^2$

$PT^2 = (\sqrt{65})^2 - 5^2$

$= 65 - 25$

$= 40$

$(\sqrt{\ }) \quad PT = \sqrt{40}$

$= \sqrt{4 \times 10}$

$= 2\sqrt{10}$ or 6·32 units

6. $d \propto \sqrt{h}$

$d = k\sqrt{h}$

when $d = 14$, $h = 16$

$d = k\sqrt{h}$

$14 = k\sqrt{16}$

$14 = 4k$

$(\div 4) \quad k = 3.5$

$\Rightarrow d = 3.5\sqrt{h}$

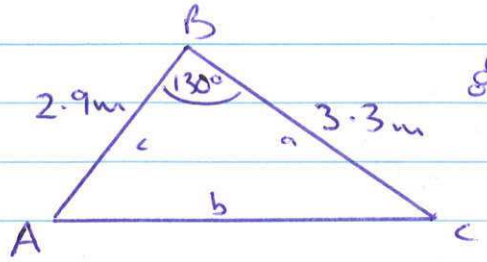
when $h = 40$

$d = 3.5\sqrt{40}$

$= 22.14$ km

$\Rightarrow$ Distance to horizon is 22·14 km

Therefore, boat at 20km is not beyond

7. 

$6 \cdot 2 - 2 \cdot 9 = 3 \cdot 3\text{m}$

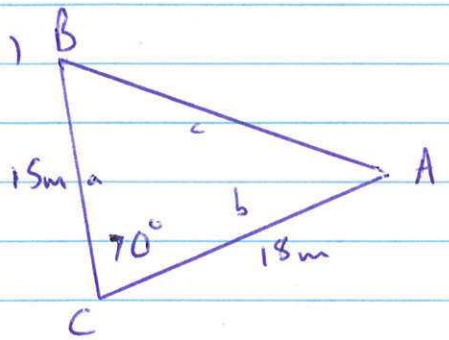
$b^2 = a^2 + c^2 - 2ac\cos B$

$= (3\,3)^2 + (2 \cdot 9)^2 - 2(3 \cdot 3)(2 \cdot 9)\cos 130°$

$= 31 \cdot 6$

$b = \sqrt{31 \cdot 6}$

$= \underline{5 \cdot 6\text{m}}$

8. (a) 

$A = \frac{1}{2}ab\sin C$

$= \frac{1}{2}(15)(18)\sin 70°$

$= \underline{126 \cdot 9\text{m}^2}$

(b) Max value of $\sin x° = 1$, when $x = 90°$

So, $x = 90°$ will give maximum area.

9. (a) $\angle AOB = \frac{5}{12} \times 360°$

$= \underline{150°}$

(b) $\frac{\text{Arc Length}}{\text{Circumference}} = \frac{\angle AOB}{360^\circ}$

$$\frac{120}{2\pi r} = \frac{150^\circ}{360^\circ}$$

$$\frac{60}{\pi r} = \frac{5}{12}$$

$$\frac{60}{\pi} = \frac{5}{12} r$$

$$r = \frac{60}{\pi} \times \frac{12}{5}$$

$$= 45.8 \text{ cm}$$

10. (a) Cost = £25 × 4 + 0·12(640 − 200)

= £152·80

(b) Cost = 25d + 0·12(m − 200)

11(a) $r = \frac{1}{2} n(n-1)$

When $n = 7$

$r = \frac{1}{2} \times 7 \times (7-1)$

$= \frac{1}{2} \times 7 \times 6$

$= 21$

(b) When $r = 55$

$$r = \frac{1}{2} n(n-1)$$

$$55 = \frac{1}{2} n(n-1)$$

$$(\times 2) \quad 110 = n(n-1)$$

$$110 = n^2 - n$$

$$(-110) \quad 0 = n^2 - n - 110$$

i.e. $\underline{n^2 - n - 110 = 0}$

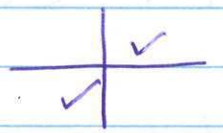
(c) $n^2 - n - 110 = 0$

$(n+10)(n-11) = 0$

either $n = -10$ or $n = 11$

n cannot be negative, therefore the number of towns is 11.

12. (a) $\tan x = 5$ 0° tan is positive in



Q1 angle is $x = \tan^{-1}(5)$

$= 78.7^\circ$

Q3 angle is $180 + 78.7 = 258.7^\circ$

$\Rightarrow \underline{x_P = 78.7^\circ, \quad x_Q = 258.7^\circ}$

(b) R will be 78.7° beyond 360°

$\Rightarrow \underline{x_R = 438.7^\circ}$

Credit Level

2009 Paper 1

1. $(846 \div 30) - 1.09$

$= 28.2 - 1.09$

$= \underline{27.11}$

BODMAS

$846 \div 30$

$= 846 \div 10 \div 3$

$= 84.6 \div 3$

$= 28.2$

28.20

$-\ 1.09$

27.11

2. $4\frac{1}{3} - 1\frac{1}{2}$

$= \frac{13}{3} - \frac{3}{2}$

$= \frac{26}{6} - \frac{9}{6}$

$= \frac{17}{6}$

$= \underline{2\frac{5}{6}}$

3. $f(x) = x^2 + 3$

(a) $f(-4) = (-4)^2 + 3$

$= 16 + 3$

$= \underline{19}$

(b) $f(t) = t^2 + 3$

$f(t) = 52$

$\therefore f(t) = t^2 + 3 = 52$

(-3) $t^2 = 49$

$(\sqrt{\ })$ $\underline{t = \pm 7}$

4. (a) $x^2 - 4y^2$

$= x^2 - (2y)^2$

$= \underline{(x-2y)(x+2y)}$

(b) $(2x-1)(x+4)$

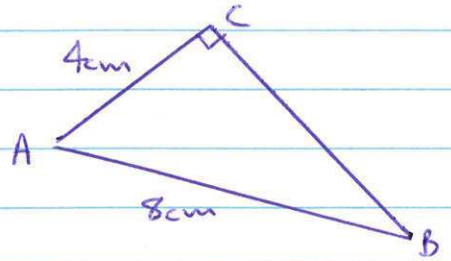
$= 2x^2 + 8x - x - 4$

$= \underline{2x^2 + 7x - 4}$

(c) $x^{\frac{1}{2}}(3x + x^{-2})$

$= \underline{3x^{3/2} + x^{-3/2}}$

5.



By Pythagoras

$a^2 = c^2 - b^2$

$BC^2 = 8^2 - 4^2$

$= 64 - 16$

$= 48$

$(\sqrt{\ }) \quad BC = \sqrt{48}$

$= \sqrt{16 \times 3}$

$= \underline{4\sqrt{3}}$

6 $P(\text{female}) = 4/18 = 2/9$

$P(5) = 1/6$

$\therefore$ more likely to be female since $2/9 > 1/6$

i.e. $4/18 > 3/18$

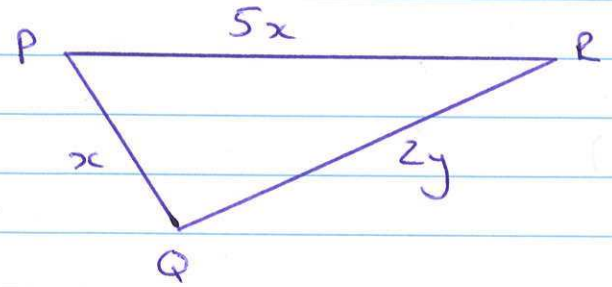
7. $130\% = £260$

$1\% = \frac{260}{130} = 2$

$\therefore 100\% = £200$

Ben paid £200 last year.

8.



(a) Perimeter: $5x + x + 2y = 42$

$6x + 2y = 42$

(b) $QR + 2 = PR$

$2y + 2 = 5x$ $\quad \therefore 5x - 2y = 2$

(c) $6x + 2y = 42$ ①

$5x - 2y = 2$ ②

① + ② $\quad 11x = 44$

$(\div 11) \quad x = 4$

Subst $x = 4$ in ①

$6x + 2y = 42$

$6(4) + 2y = 42$

$24 + 2y = 42$

$(-24) \quad 2y = 18$

$(\div 2) \quad y = 9$

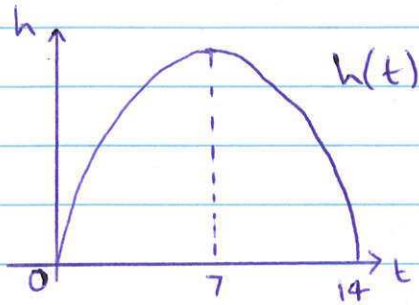
Sol^{n} is $x = 4, y = 9$

9. $f = \frac{kd^2}{20}$

$(\times 20)$ $20f = kd^2$

$(\div k)$ $\frac{20f}{k} = d^2$

$(\sqrt{\ })$ $d = \sqrt{\frac{20f}{k}}$

10. 

$h(t) = -2t(t-14)$

(a) $-2t(t-14) = 0$

$\Rightarrow t = 0$ and $t = 14$

∴ the rocket is in flight 14 seconds.

(b) The maximum height occurs at $t = 7$

So, $h(t) = -2t(t-14)$

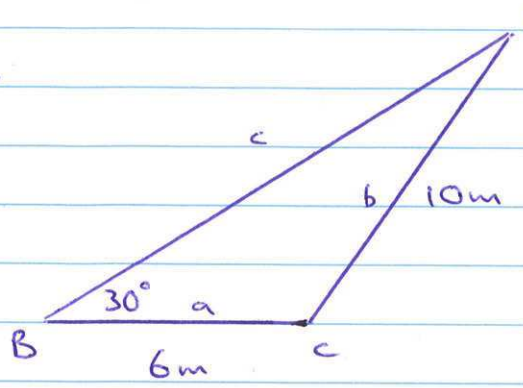
$h(7) = -2(7)(7-14)$

$= -14(-7)$

$= 98$

∴ the maximum height is 98 m

11.



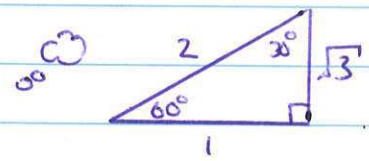
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\frac{6}{\sin A} = \frac{10}{\sin 30}$$

$$6\sin 30 = 10\sin A$$

$$(\div 10) \quad \frac{6\sin 30}{10} = \sin A$$



$$\therefore \sin 30 = \frac{1}{2}$$

$$\frac{6 \times 0.5}{10} = \sin A$$

$$\sin A = \frac{3}{10}$$

$$= 0.3$$

Credit Level

2009 Paper 2

1. $1000 \div (3.27 \times 10^{-22})$

$= 3.0581\ldots \times 10^{24}$

$= \underline{3.1 \times 10^{24}}$

2. $V_{glass} = \pi r^2 h$

$= \pi \times 3^2 \times 8$

$= 226.19\ cm^3$

2 litres $= 2000\ cm^3$

So, $2000 \div 226.19$

$= 8.84$ glasses

$\therefore$ 8 full glasses can be poured from the bottle.

3. $x^2 - 4x - 6 = 0$

$a=1 \quad b=-4 \quad c=-6$

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

$$= \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-6)}}{2(1)}$$

$b^2 - 4ac = (-4)^2 - 4(1)(-6)$

$= 16 + 24$

$= 40$

$$= \frac{4 \pm \sqrt{40}}{2}$$

$= \frac{4+\sqrt{40}}{2}$ or $\frac{4-\sqrt{40}}{2}$

$= 5.1622...$ or -1.1622

$= \underline{5.2}$ or $\underline{-1.2}$ (1 dp)

4.

Scale Factor (length) $= 10/4 = 2.5$

Scale Factor (area) $= (2.5)^2$

Larger magnet $= (2.5)^2 \times 18$

$= \underline{112.5 cm^2}$

5. New mean $= £360 + £12$

$= \underline{£372}$

Standard Deviation remains the same $= \underline{£74}$

6. Using $(9, 21)$ and $(15, 33)$
x_1, y_1 x_2, y_2

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{33-21}{15-9}$

$= \frac{12}{6}$

$= 2$

So far, $y = 2x + c$

Subst (9, 21) in $y = 2x + c$

$21 = 2 \times 9 + c$

$21 = 18 + c$

$(-18) \quad 3 = c$

So, $\underline{y = 2x + 3}$

(b) Subst $x = 20$ in $y = 2x + 3$

$y = 2(20) + 3$

$= 40 + 3$

$= 43$

Estimate for sport score is 43

7. (a) $t \propto \frac{1}{d^2}$

$t = \frac{k}{d^2}$

(b) $50 = \frac{k}{2^2}$

$50 = \frac{k}{4}$

$(\times 4) \quad 200 = k$

$\therefore \quad t = \frac{200}{d^2}$

When $d = 5 \quad t = \frac{200}{5^2}$

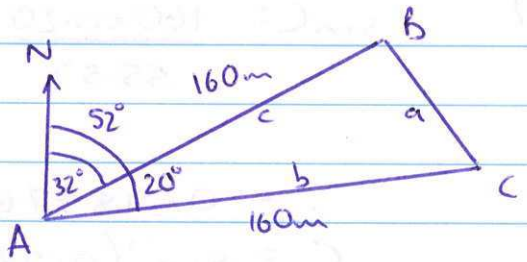
$= \frac{200}{25}$

$= 8$

8. $90 \times 0.8^3 = 46.08\text{g}$

No, they will not achieve their aim. If the company had been successful, a bag of crisps would have 45g of fat $\Rightarrow$ 1.08g too much fat.

9. (a)



$\angle BAC = 20°$

(b) $a^2 = b^2 + c^2 - 2bc\cos A$

$= 160^2 + 160^2 - 2(160)(160)\cos 20$

$= 51200 - 48112.26218$

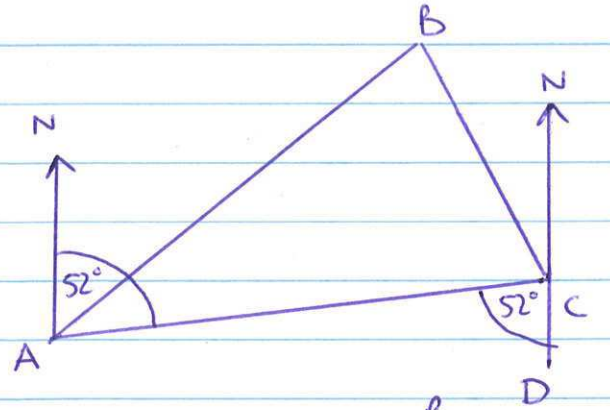
$= 3087.73782$

$(\sqrt{\ }) \quad a = \sqrt{3087.73782}$

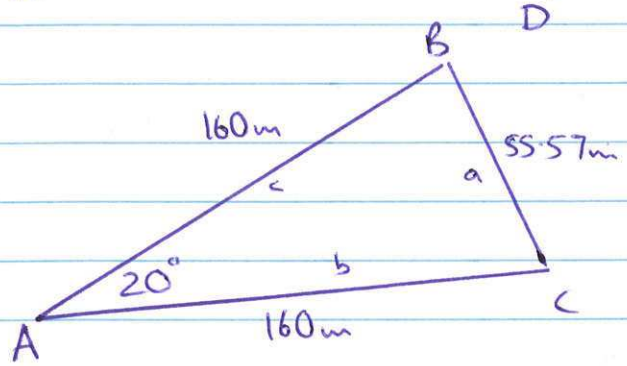
$= 55.567\ldots$

$= 55.57\text{m}$

(c)



$\angle ACD = 52°$ ∴ Z shaped angle



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{a}{\sin A} = \frac{c}{\sin C}$$

$$\frac{55.57}{\sin 20} = \frac{160}{\sin C}$$

$$55.57 \sin C = 160 \sin 20$$

$(\div 55.57)$

$$\sin C = \frac{160 \sin 20}{55.57}$$

$$= 0.984761\ldots$$

$$C = \sin^{-1}(0.984761\ldots)$$

$$= 79.9849\ldots°$$

$$= 80°$$

Thus the bearing of B from C $= 180° + 52° + 80°$

$= 312°$

10. $W = \frac{1}{4}(M^2 - 4M + 272)$

$83 = \frac{1}{4}(M^2 - 4M + 272)$

$(\times 4)$ $332 = M^2 - 4M + 272$

(-332) $M^2 - 4M - 60 = 0$

$(M-10)(M+6) = 0$

$M = 10$ or $M = -6$ (IGNORE)

Therefore the giraffe will weigh 83kg after 10 months

11.(a) $\frac{\text{Area of Sector}}{\text{Area of Circle}} = \frac{x^\circ}{360^\circ}$

$\frac{A}{\pi r^2} = \frac{x}{360^\circ}$

$\frac{A}{\pi \times 30^2} = \frac{260}{360}$

$A = \frac{260}{360} \times \pi \times 30^2$

$= 2042.035225$

$= 2042.04 \text{ cm}^2$

(b) $\frac{\text{Length of Arc}}{\text{Circumference}} = \frac{x^\circ}{360^\circ}$

$$\frac{AB}{2\pi r} = \frac{260}{360}$$

$$\frac{AB}{2\times\pi\times 30} = \frac{260}{360}$$

$$AB = \frac{260}{360} \times 2\times\pi\times 30$$

$$= 136.1356817$$

$$= \underline{136.14 \text{ cm}}$$

12 (a) $T_{20} = \frac{1}{2} \times 20(20+1)$

$= \frac{1}{2} \times 20(21)$

$= \frac{1}{2} \times 420$

$= \underline{210}$

(b) $T_n = \frac{1}{2} \times n(n+1)$

So, $T_{n+1} = \frac{1}{2} \times (n+1)(n+1+1)$

$= \frac{1}{2} \times (n+1)(n+2)$

$= \frac{1}{2} \times (n^2 + 2n + n + 2)$

$= \underline{\frac{1}{2} \times (n^2 + 3n + 2)}$

(c) $T_n + T_{n+1}$

$= \frac{1}{2} \times n(n+1) + \frac{1}{2}(n^2 + 3n + 2)$

$= \frac{1}{2} \times (n^2 + n) + \frac{1}{2} \times (n^2 + 3n + 2)$

$= \frac{1}{2}n^2 + \frac{1}{2}n + \frac{1}{2}n^2 + \frac{3}{2}n + 1$

$= n^2 + 2n + 1$

$= (n+1)^2$

$\therefore$ Since $T_n + T_{n+1} = (n+1)^2$

then $T_n + T_{n+1}$ is a square number.

Credit Level

2010 Paper 1

1. 40% of £11.50 − £1.81

$= \frac{4}{10} \times 11.50 - 1.81$

$= 4.60 - 1.81$

$= £2.79$

BODMAS

$11.50 \div 10 \times 4$

$= 1.15 \times 4$

$= 4.60$

2. $\frac{2}{5} \div 1\frac{1}{10}$

$= \frac{2}{5} \div \frac{11}{10}$

$= \frac{2}{5} \times \frac{10}{11}$

$= \frac{20}{55}$

$= \frac{4}{11}$

3. $t = \frac{7s + 4}{2}$

$(\times 2)\ 2t = 7s + 4$

$(-4)\ 2t - 4 = 7s$

$(\div 7)\ s = \frac{2t - 4}{7}$

4. (a) $f(x) = g(x)$

$x^2 - 4x = 2x + 7$

$(-2x)\ x^2 - 6x = 7$

$(-7)\ x^2 - 6x - 7 = 0$

(b) $x^2 - 6x - 7 = 0$

$(x+1)(x-7) = 0$

$\therefore\ x = -1$ or $x = 7$

5. (a) P(black) = $4/9$

P(white) = $5/9$

(b) White marbles = $5/9 \times 27$

$= 27 \div 9 \times 5$

$= 15$

There are 15 white marbles

6. 20% extra $\Rightarrow$ 120% = 900g

20% = $900 \div 6$

$= 150g$

100% = $150g \times 5$

$= 750g$

A standard box contains 750g of powder.

7. (a) $y = mx + c$ (2, 7)

$7 = 2m + c$

(b) $y = mx + c$ (4, 17)

$17 = 4m + c$

(c) $2m + c = 7$ ①

$4m + c = 17$ ②

① × 2 $4m + 2c = 14$ ③

③ - ② $c = -3$

Subst $c = -3$ in ①

$2m + c = 7$

$2m + (-3) = 7$

$2m - 3 = 7$

(+3) $2m = 10$

(÷2) $m = 5$

$\Rightarrow$ $m = 5$ and $c = -3$

(d) The gradient, $m = 5$

8. (a) $\sqrt{2} \times \sqrt{18}$

$= \sqrt{36}$

$= 6$

(b) $\sqrt{2} + \sqrt{18}$

$= \sqrt{2} + \sqrt{9 \times 2}$

$= \sqrt{2} + 3\sqrt{2}$

$= 4\sqrt{2}$

(c) $\dfrac{\sqrt{2} \times \sqrt{18}}{\sqrt{2} + \sqrt{18}} = \dfrac{6}{4\sqrt{2}}$

$= \dfrac{6}{4\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}}$

$= \dfrac{6\sqrt{2}}{4 \times 2}$

$= \dfrac{6\sqrt{2}}{8}$

$= \dfrac{3\sqrt{2}}{4}$

9. $y = \frac{1}{3}x + 2$

∴ B lies on x-axis

↳ on x-axis, $y = 0$

So, $0 = \frac{1}{3}x + 2$

$(\times 2)$ $-2 = \frac{1}{3}x$

$(\times 3)$ $x = -6$

$\Rightarrow B(-6, 0)$

(b) $y < 0$ for all points left of B

i.e. $y < 0$ for $x < -6$

10. (a) $1^3 + 2^3 + 3^3 + 4^3 + 5^3 = \frac{5^2 \times 6^2}{4}$

(b) $1^3 + 2^3 + 3^3 + \ldots + n^3 = \frac{n^2 \times (n+1)^2}{4}$

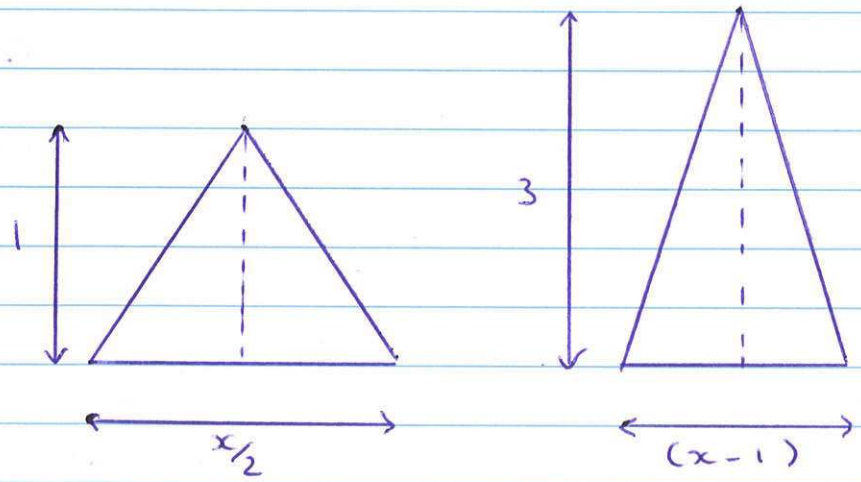
(c) $1^3 + 2^3 + 3^3 + \ldots + 9^3 = \frac{9^2 \times 10^2}{4}$

$= \frac{81 \times 100}{4}$

$= \frac{8100}{4}$

$= 2025$

11.



$A = \frac{1}{2} \times \frac{x}{2} \times 1$

$= x/4$

$A = \frac{1}{2} \times (x-1) \times 3$

$= \frac{3}{2}(x-1)$

So, $\frac{x}{4} = \frac{3}{2}(x-1)$

$(\times 4)$ $x = \frac{12}{2}(x-1)$

$x = 6(x-1)$

$x = 6x - 6$

$6 = 5x$

$(\div 5)$ $x = 6/5$

Credit Level

2010 Paper 2

1. Weight $= 84000 \times 0.75^3$

$= 35437.5$

Weight = 35400 tonnes (3 sig figs)

2. $x(x-1)^2$

$= x(x-1)(x-1)$

$= x(x^2 - 2x + 1)$

$= x^3 - 2x^2 + x$

3. mean, $\bar{x} = \frac{808}{8}$

$\bar{x} = 101$

x	$x - \bar{x}$	$(x-\bar{x})^2$
102	1	1
102	1	1
101	0	0
98	-3	9
99	-2	4
101	0	0
103	2	4
102	1	1
		$\Sigma(x-\bar{x})^2 = 20$

$$s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

$$s = \sqrt{\frac{20}{7}}$$

$s = 1.69$

(b)
- The second machine averaged two more pins per box
- The standard deviation of the second machine is higher, indicating a greater variation in the number of matches in each box.

4. $3x^2 + 5x - 7 = 0$

$a = 3 \quad b = 5 \quad c = -7$

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

$$= \frac{-5 \pm \sqrt{5^2 - 4(3)(-7)}}{6}$$

$$= \frac{-5 \pm \sqrt{109}}{6}$$

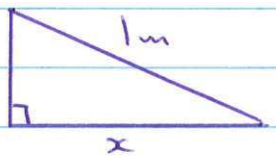
where $b^2 - 4ac = 5^2 - 4(3)(-7) = 109$

So, $x = \frac{-5 + \sqrt{109}}{6}$ or $x = \frac{-5 - \sqrt{109}}{6}$

$= 0.907$ or -2.573

$\Rightarrow$ $x = -2.6$ or 0.9

5(a)



By Pythagoras

$a^2 = c^2 - b^2$

$x^2 = 1^2 - (0.5)^2$

$= 1 - 0.25$

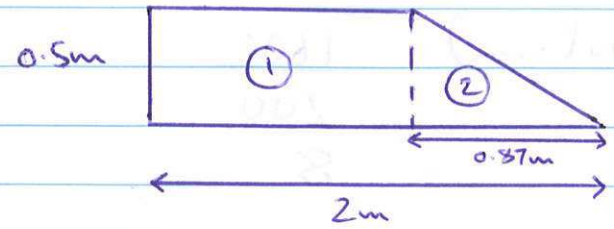
$= 0.75$

(ii) $x = \sqrt{0.75}$

$= 0.866$

$x = 0.87$ m (to 2 dp)

(b)



$A_1 = lb$
$= 1.13 \times 0.5$
$= 0.565$

$A_2 = \frac{1}{2}bh$
$= \frac{1}{2} \times 0.87 \times 0.5$
$= 0.2175$

Total Area $= 0.565 + 0.2175$
$= 0.7825\ m^2$

Volume $= Ah$
$= 0.7825 \times 2$
$= 1.565\ m^3$

6. $\frac{\text{Arc Length}}{\text{Circumference}} = \frac{x}{360}$

$\frac{AB}{2\pi r} = \frac{140}{360}$

$\frac{AB}{72\pi} = \frac{140}{360}$

$AB = \frac{140}{360} \times 72\pi$

$= 87.96\ cm$

Arc AB $= 88.0\ cm$ (to 1 dp)

7. Scale Factor (volume) $= \frac{1600}{200}$

$= 8$

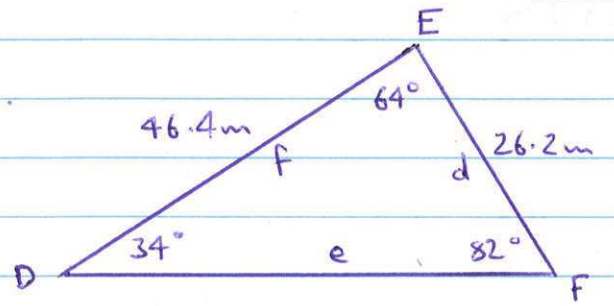
Scale Factor (length) $= \sqrt[3]{8}$

$= 2$

$\Rightarrow$ Salon Bottle $= 2 \times 12\text{cm}$

$= \underline{24\text{cm}}$

8.



You know all the angles and two sides so you can use either Sine Rule or Cosine Rule.

$\frac{d}{\sin D} = \frac{e}{\sin E} = \frac{f}{\sin F}$

or $e^2 = d^2 + f^2 - 2df\cos E$

$= (26.2)^2 + (46.4)^2 - 2(26.2)(46.4)\cos 64$

$= 1773.6$

$\frac{d}{\sin D} = \frac{e}{\sin E}$

$(\sqrt{}) \quad e = \sqrt{1773.6}$

$= 42.1\text{m}$

$\frac{26.2}{\sin 34} = \frac{e}{\sin 64}$

$\times \sin 64 \quad e = \frac{26.2\sin 64}{\sin 34}$

$= 42.111\ldots$

$= 42.1\text{m}$

Perimeter of DEF $= 114.7\text{m}$

$\frac{1000}{114.7} = 8.7$

$\Rightarrow$ The footballers must run 9 complete circuits to cover at least 1000m.

9. $5 \times 0.8 = 4$

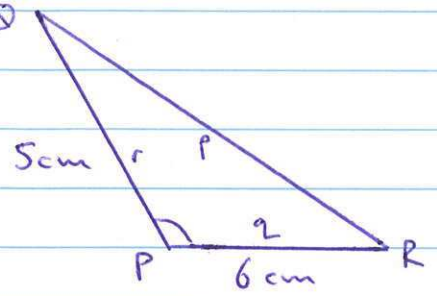
$4 \times 1.2 = 4.8$

$\Rightarrow$ New ratio is $4 : 4.8$

$40 : 48$

$5 : 6$

10.



Using $A = \frac{1}{2}ab\sin C$

$A = \frac{1}{2}qr\sin P$

$12 = \frac{1}{2} \times 6 \times 5 \times \sin P$

$12 = 15\sin P$

$(\div 15)$ $\sin P = 12/15$

sin is positive in ✓ | ✓

Q1 angle is $P = \sin^{-1}(12/15) = 53.1°$

Q2 angle is $180 - 53.1 = 126.9°$

Thus $\angle QPR = 126.9°$

11(a) $h \propto \frac{V}{b^2}$

$\Rightarrow h = \frac{kV}{b^2}$

(b) $12 = \frac{256k}{8^2}$

$12 = \frac{256k}{64}$

$12 = 4k$

$(\div 4)$ $k = 3$

$\Rightarrow h = \frac{3v}{b^2}$

So, when $V = 600$ and $b = 10$

$h = \frac{3(600)}{10^2}$

$= \frac{1800}{100}$

$= 18\text{ cm}$

12. By Pythagoras

$c^2 = a^2 + b^2$

$(x+8)^2 = (x+7)^2 + x^2$

$x^2 + 16x + 64 = x^2 + 14x + 49 + x^2$

$(-x^2)$ $16x + 64 = x^2 + 14x + 49$

$(-16x)$ $64 = x^2 - 2x + 49$

(-64) $0 = x^2 - 2x - 15$

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

$\Rightarrow x = -3, 5$

As x is a length, $x = 5\text{ cm}$

13 (a) $D = 3 + 1.75 \sin 30h$

when $h = 5$,

$$D = 3 + 175 \sin 150°$$
$$= 3.875$$
$$= 3.88 \text{ m} \quad \text{(to 2dp)}$$

(b) Max value of $1.75 \sin 30h = 1.75$
Min value of $1.75 \sin 30h = -1.75$

Max depth $= 3 + 1.75$
$= 4.75 \text{ m}$

Min depth $= 3 - 1.75$
$= 1.25 \text{ m}$

Maximum difference $= 4.75 - 1.25$
$= 3.5 \text{ m}$

Credit Level

2011 Paper 1

1. $2.4 + 5.46 \div 60$

$= 2.4 + 0.091$

$= \underline{2.491}$

$5.46 \div 10 = 0.546$

$0.546 \div 6 = 0.091$

2. $2m^2 - 18$

$= 2(m^2 - 9)$

$= \underline{2(m-3)(m+3)}$

3. $f(x) = 5 - x^2$

$f(-3) = 5 - (-3)^2$

$= 5 - 9$

$= \underline{-4}$

4. $3x + 1 = \frac{x-5}{2}$

$(\times 2)$ $6x + 2 = x - 5$

(-2) $6x = x - 7$

$(-x)$ $5x = -7$

$(\div 5)$ $\underline{x = -7/5}$

5. $7 \div 2/5$

$= 7 \times 5/2$

$= 35/2$

$= 17.5$

Therefore, Jamie can make $\underline{17}$ cakes

6 (a) Median of 30 values is between 15th and 16th values

$\Rightarrow$ median = 4

(b) $P(t>4) = {}^{14}/_{30}$

$= {}^{7}/_{5}$

7 (a) $2a + 4c = 56$

(b) $a + 3c = 36$

(c) $2a + 4c = 56$ ①

$a + 3c = 36$ ②

② × 2 $2a + 6c = 72$ ③

③ − ① $2c = 16$

(÷2) $c = 8$

A child ticket costs £8

(ii) Subst $c = 8$ in ①

$2a + 4c = 56$

$2a + 4(8) = 56$

$2a + 32 = 56$

(−32) $2a = 24$

(÷2) $a = 12$

An adult ticket costs £12

8.(a) $T(0,12)$, $Q(8,8)$

x_1, y_1 so $R(8,0)$

x_2, y_2

$$m_{TR} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{0 - 12}{8 - 0}$$

$$= \frac{-12}{8}$$

$$= -3/2$$

$y = mx + c$

TR: $y = -3/2x + 12$

(b) $P(x, 8)$

when $y = 8$

$$8 = -3/2x + 12$$

(-12) $-4 = -3/2x$

$(\times 2)$ $-8 = -3x$

$(\div -3)$ $\frac{8}{3} = x$

$x = 8/3$

$P(8/3, 8)$

9.(a) $2a \times a^{-4}$

$= 2a^{-3}$

(b) $\sqrt{x} + \sqrt{18} = 4\sqrt{2}$

$\sqrt{x} = 4\sqrt{2} - \sqrt{18}$

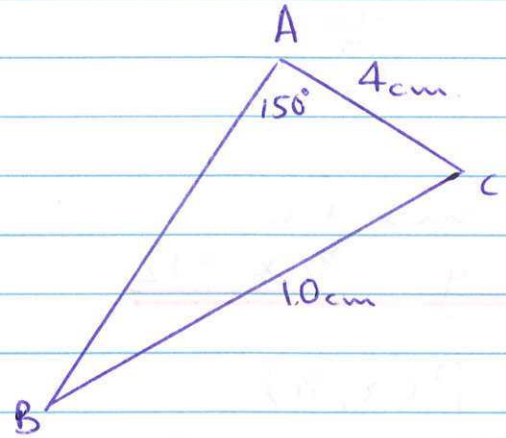
$\sqrt{x} = 4\sqrt{2} - \sqrt{9 \times 2}$

$\sqrt{x} = 4\sqrt{2} - 3\sqrt{2}$

$\sqrt{x} = \sqrt{2}$

$\therefore \quad x = 2$

10. $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$



$\frac{a}{\sin A} = \frac{b}{\sin B}$

$\frac{10}{\sin 150^\circ} = \frac{4}{\sin B}$

$10 \sin B = 4 \sin 150$

$\sin B = \frac{4 \sin 150}{10}$

$\sin 150 = \sin 30 = \frac{1}{2}$

$\therefore 4 \times \frac{1}{2} = 2$

$\sin B = \frac{2}{10}$

$\sin B = \frac{1}{5}$

11. (a) $F \propto s/d^2$

$F = ks/d^2$

(b) $F = s = d = 1 \Rightarrow k = 1$

$$F = \frac{1/2}{4}$$
$$= \underline{\underline{1/8}}$$

12 (a) $S_{10} = 1+2+3+\ldots+10$
$= \frac{1}{2}(10 \times 11)$
$= \underline{\underline{55}}$

(b) $S_n = 1+2+3+\ldots+n$
$= \frac{1}{2}(n \times (n+1))$
$= \frac{1}{2}(n^2+n)$
$= \underline{\underline{\frac{n^2+n}{2}}}$

Credit Level

2011 Paper 2

1. $28 \times (1.1)^4 = 40.994$

$= \underline{41 \text{ miles}}$

2. $(3x+1)(x^2-5x+4)$

$= 3x^3 - 15x^2 + 12x + x^2 - 5x + 4$

$= \underline{3x^3 - 14x^2 + 7x + 4}$

3. $2x^2 + 3x - 7 = 0$

$a=2 \quad b=3 \quad c=-7$

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

$x = \dfrac{-3 \pm \sqrt{65}}{4}$

$x = \dfrac{-3+\sqrt{65}}{4}$ or $\dfrac{-3-\sqrt{65}}{4}$

$x = 1.26$ or -2.77

$\underline{x = 1.3}$ or $\underline{-2.8}$ to 2 sig fig

oo $b^2 - 4ac$
$= 3^2 - (4 \times 2 \times (-7))$
$= 9 - (-56)$
$= 65$

4. $84\% = £3780$

$1\% = \dfrac{£3780}{84}$

$= £45$

$100\% = £45 \times 100$

$= £4500$

Last year the car was worth $\underline{£4500}$

5. $\frac{\text{Arc Length}}{\text{Circumference}} = \frac{x}{360}$

$$\frac{BC}{2\pi r} = \frac{42}{360}$$

$$\frac{BC}{2.4\pi} = \frac{42}{360}$$

$$BC = \frac{42 \times 2.4\pi}{360}$$

$$= 0.879...$$

$BC < 0.9m \Rightarrow$ the staircase does not comply

6. Scale Factor (length) $= \frac{125}{90}$

Scale Factor (area) $= \left(\frac{125}{90}\right)^2$

$$\text{Area } B = \left(\frac{125}{90}\right)^2 \times 4020$$

$$= 7754.6296...$$

Area B is not double Area A.
The claim is not justified.

7. (a) $\angle ABC = 108^\circ$

(b) $a^2 = b^2 + c^2 - 2bc\cos A$

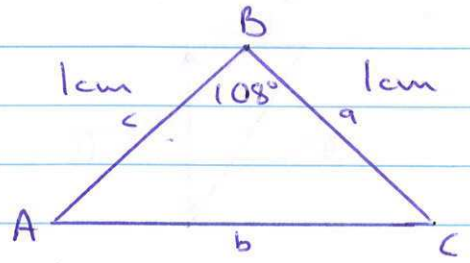
$b^2 = a^2 + c^2 - 2ac\cos B$

$b^2 = 1^2 + 1^2 - 2(1)(1)\cos 108$

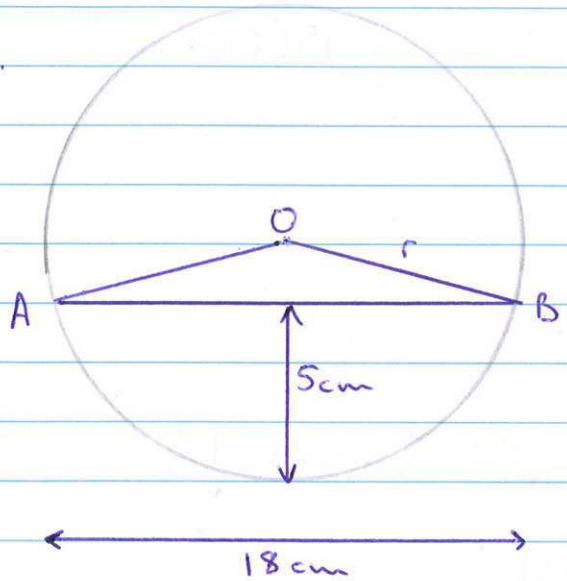
$b^2 = 2.6\text{ cm}$

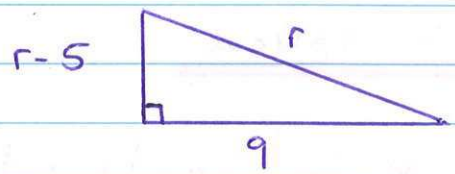
$b = \sqrt{2.6}$

$b = 1.6\text{ cm}$ (to 1 dp)



8.





By Pythagoras,

$c^2 = a^2 + b^2$

$r^2 = (r-5)^2 + 9^2$

$r^2 = r^2 - 10r + 25 + 81$

$r^2 = r^2 - 10r + 106$

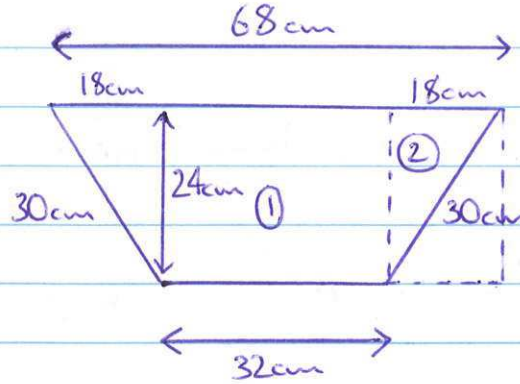
$(-r^2)$ $\quad 0 = -10r + 106$

$(+10r)$ $\quad 10r = 106$

$(\div 10)$ $\quad r = 10.6$

Therefore, radius = 10.6cm

9. (a)



$A_{①} = 32 \times 24$ $A_{②} = 24 \times 18$

$= 768\text{cm}^2$ $= 512\text{cm}^2$

Total cross-section area $= 768 + 512$

$= \underline{1200\text{cm}^2}$

(b) $V = Ah$ 156 litres $= 156000\text{ml}$

$= 156000\text{cm}^3$

So, $V = Al$

$156000 = 1200 \times l$

$(\div 1200)$ $l = \frac{156000}{1200}$

$\underline{l = 130\text{cm}}$

10. Let x be hourly rate $\frac{1}{3}$ more $= 1\frac{1}{3}$

$= \frac{4}{3}$

So, $15x + 8x + 12\left(\frac{4}{3}x\right) = 429$

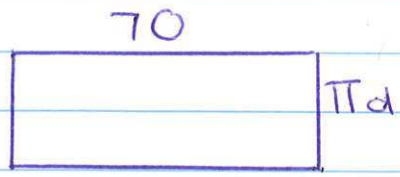
$23x + 16x = 429$

$39x = 429$

$(\div 39)$ $x = 11$

Tom is paid £11 per hour, £165 for 15 hours

11. Amount of paper to go once round the cylinder is $3000 \div 3 = 1000\,cm^2$



$1000 = \pi \times d \times 70$

$(\div 70\pi)$ $d = \dfrac{1000}{70\pi}$

$= 4.55\,cm$

12. (a) $\underline{P(90, 1)}$

(b) $4\sin x - 3 = 0$

$(+3)$ $4\sin x = 3$

$(\div 4)$ $\sin x = 3/4$ ∴ sin is positive in Q1 and Q2

Q1 angle is $\sin x = 3/4$

$x = \sin^{-1}(3/4)$

$x = 48.6°$

Q2 angle is $180 - 48.6 = 131.4°$

So, $\underline{Q(48.6, 0)}$ and $\underline{R(131.4, 0)}$

13. $48 + 8t - t^2 = 0$

$(\times -1)$ $t^2 - 8t - 48 = 0$

$(t + 4)(t - 12) = 0$

$t = -4$ or $t = 12$
(ignore)

So, $\underline{t = 12 \text{ seconds}}$

2012 CREDIT MATHS SOLUTIONS

PAPER 1

1. $7{\cdot}2 - 0{\cdot}161 \times 30$

$= 7{\cdot}2 - 4{\cdot}83$

$= 2{\cdot}37$

$$\begin{array}{r} 1{\cdot}61 \\ \times\ 3 \\ \hline 4{\cdot}83 \end{array} \qquad \begin{array}{r} {}^{6}\cancel{7}{\cdot}{}^{1}2\,0 \\ -\ 4{\cdot}83 \\ \hline 2{\cdot}37 \end{array}$$

2. $(3x-2)(2x^2+x+5)$

$= 3x(2x^2+x+5) - 2(2x^2+x+5)$

$= 6x^3 + 3x^2 + 15x - 4x^2 - 2x - 10$

$= 6x^3 - x^2 + 13x - 10$

3. $L = \dfrac{\sqrt{m}}{k}$

$kL = \sqrt{m}$

$m = (kL)^2$

$(m = k^2L^2)$

4. $QR^2 = PQ^2 - PR^2$

$QR^2 = (12)^2 - (10)^2$

$QR^2 = 144 - 100$

$QR^2 = 44$

$QR = \sqrt{44}$

$QR = \sqrt{4} \times \sqrt{11}$

$QR = 2\sqrt{11}$

5. Last week: $\frac{18}{30}$ This week: $\frac{16}{25}$

$= \frac{6}{10}$ $= \frac{64}{100}$

$= 60\%$ $= 64\%$

By comparing percentages we can see that his scoring rate improved.

6. (a) Axis of symmetry at $x = 2$ (midpoint of roots)

(b) when $x = 2$, $y = 5 + 4(2) - (2)^2$

$y = 5 + 8 - 4$

$y = 9$

Maximum value is 9

7. $2x^2 - 2x - 1 = 0$

$a = 2 \quad b = -2 \quad c = -1$

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

$$x = \frac{-(-2) \pm \sqrt{(-2)^2-4(2)(-1)}}{2(2)}$$

$$x = \frac{2 \pm \sqrt{4+8}}{4}$$

$$x = \frac{2 \pm \sqrt{12}}{4}$$

$$x = \frac{2 \pm 2\sqrt{3}}{4}$$

$$x = \frac{1 \pm \sqrt{3}}{4}$$

8 $y = 2x - 3$

$y + 3 = 2x$

$2x - y = 3$ ①

(SUBSTITUTION METHOD)

$x + 2(2x-3) = 14$

$x + 4x - 6 = 14$

$5x = 20$

$x = 4$

$y = 2(4) - 3$

$y = 5$

$\therefore P(4,5)$

$2x - y = 3$ ①

$x + 2y = 14$ ②

(ELIMINATION METHOD)

$2x - y = 3$ ①

$-\ 2x + 4y = 28$ ② x2

$-5y = -25$

$y = 5$

sub $y = 5$ into ①

$2x - (5) = 3$

$2x = 8$

$x = 4$

check using ②

$(4) + 2(5) = 14$

$4 + 10 = 14$

LHS ≡ RHS

$\therefore P(4,5)$

9. (a) $T_1 = \frac{D}{S}$ (b) $T_2 = \frac{D}{S}$

$T_1 = \frac{40}{x}$ $T_2 = \frac{40}{(x+5)}$

(c) $T_1 - T_2 = \frac{40}{x} - \frac{40}{(x+5)}$

$= \frac{40(x+5)}{x(x+5)} - \frac{40x}{x(x+5)}$

$= \frac{40x + 200 - 40x}{x(x+5)}$

$= \frac{200}{x(x+5)}$

10. (a) $(2^3)^2 = 2^6$

$= 64$

(b) $(2^3)^n = \frac{1}{64}$

$2^{-6} = \frac{1}{64}$

$\Rightarrow n = -2$

11. (a) $\underbrace{2 + 4 + 6 + 8 + 10 + 12 + 14 + 16 + 18 + 20}_{10 \text{ terms}} = 10 \times 11 = 110$

(b) $\frac{n}{2} \times \left(\frac{n}{2} + 1\right)$

$= \frac{n}{2}\left(\frac{n}{2} + 1\right)$

(c) Note: sequence began at 10

$\frac{100}{2}\left(\frac{100}{2} + 1\right) - (2 + 4 + 6 + 8)$

$= 50 \times 51 - 20$

$= 2550 - 20$

$= 2530$

1. $2\,690\,000(1{\cdot}04)^3 = 3\,025\,884{\cdot}18$

$= 3\,030\,000$

$= 30{\cdot}3$ million vehicles

2. (a) Semi-interquartile Range $= \frac{51-23}{2}$

$= 14$

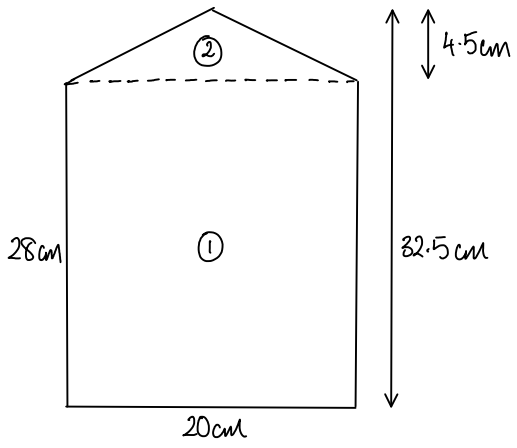
(b) Examples of valid statements:

- Interquartile range smaller after training
- Semi-interquartile " " " "
- Range " " "

} athletes performance more consistent with each other

- Median higher after training hence improved performance
- Minimum / Maximum " " " " "

3.



$A_{①} = lb$

$= 28 \times 20$

$= 560\,cm^2$

$A_{②} = \frac{1}{2}bh$

$= \frac{1}{2} \times 20 \times 4{\cdot}5\,cm$

$= 45\,cm^2$

Total area $= 560 + 45$

$= 605\,cm^2$

$V = Ah$

$V = 605 \times 9$

$V = 5445\,cm^3$

$V = 5445\,ml$

$V = 5{\cdot}445$ litres

Volume = 5 litres to nearest litre

4. $AB = \frac{65^\circ}{360^\circ} \times \pi(4{\cdot}6)$

$= 2{\cdot}6\,m$

5. $d \propto \frac{V}{r^2}$

$d = \frac{kV}{r^2}$

When $V = 60000$, $d = 50$, $r = 20$

$50 = \frac{60000k}{(20)^2}$

$50 = \frac{60000k}{400}$

$50 = 150k$

$k = \frac{50}{150}$

$k = \frac{1}{3} \Rightarrow d = \frac{V}{3r^2}$

When $V = 75000$, $r = 25$

$d = \frac{75000}{3(25)^2}$

$d = \frac{75000}{1875}$

$d = 40\text{ cm}$

6. $104\% = £894.40$

$1\% = £894.40 \div 104$

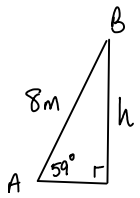
$= 8.6$

$100\% = 8.6 \times 100$

$= £860$

Cost without booking fee is £860

7.

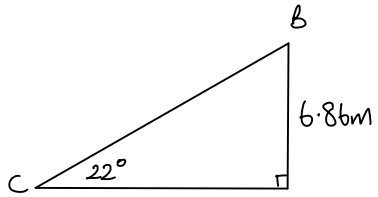


$\sin x^\circ = \frac{\text{opp}}{\text{hyp}}$

$\sin 59^\circ = \frac{h}{8}$

$h = 8\sin 59^\circ$

$h = 6.86\text{m}$



$\sin x^\circ = \frac{\text{opp}}{\text{hyp}}$

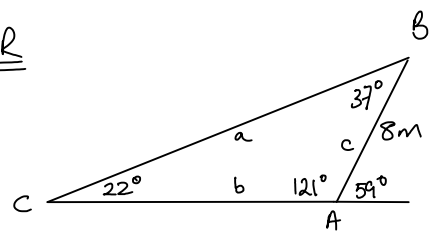
$\sin 22^\circ = \frac{6.86}{CB}$

$CB \sin 22 = 6.86$

$CB = \frac{6.86}{\sin 22}$

$CB = 18.31\text{m}$

OR



$\frac{a}{\sin A} = \frac{c}{\sin C}$

$\frac{CB}{\sin 121^\circ} = \frac{8}{\sin 22}$

$CB = \frac{8\sin 121^\circ}{\sin 22^\circ}$

$CB = 18.31\text{m}$

✓ $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ ✓ ✓

8. Scale Factor (length) $= \frac{4}{0.8}$

$= \frac{40}{8}$

$= 5$

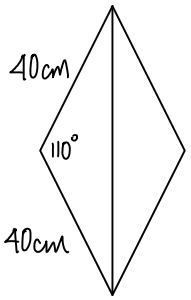
Scale Factor (Area) $= 5^2$

$= 25$

Area of large bead $= 25 \times 0.6$

$= 15\ cm^2$

9.



Area of $\Delta = \frac{1}{2}ab\sin C$

$= \frac{1}{2}(40)(40)\sin 110°$

$= 751.75\ cm^2$

Area of rhombus $= 2 \times 751.75$

$= 1503.5\ cm^2$

10. (a) From graph, y-intercept $= 1.8$

$(0, 1.8)$ $(4, 6.6)$ $\Rightarrow$ $y = 1.2x + 1.8$

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$f = 1.2d + 1.8$

$m = \frac{6.6 - 1.8}{4 - 0}$

$m = \frac{4.8}{4}$

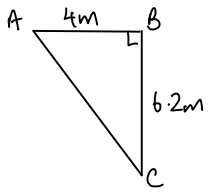
$m = 1.2$

(b) $f = 1.2(7) + 1.8$

$f = 10.2$

$\Rightarrow$ Fare is £10.20

11. (a)



$AC^2 = (6.2)^2 + (4)^2$

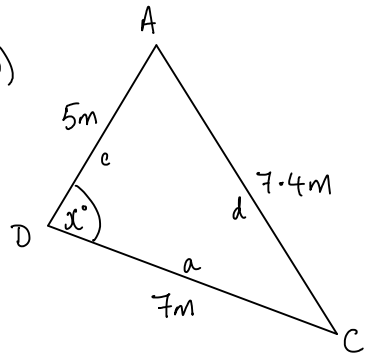
$AC^2 = 38.44 + 16$

$AC^2 = 54.44$

$AC = \sqrt{54.44}$

$AC = 7.4m$

(b)



$$\cos D = \frac{a^2 + c^2 - d^2}{2ac}$$

$$\cos D = \frac{(7)^2 + (5)^2 - (7.4)^2}{2(7)(5)}$$

$$\cos D = \frac{49 + 25 - 54.44}{70}$$

$$\cos D = \frac{19.56}{70}$$

$$D = \cos^{-1}\left(\frac{19.56}{70}\right)$$

$$D = 73.8^\circ$$

Angle ADC = 73.8°

12. (a) $f(270) = 3\sin(270)^\circ$

$= -3$

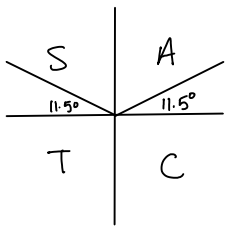
(b) $f(t) = 0.6$

$3\sin t^\circ = 0.6$

$\sin t^\circ = 0.2$

Acute angle $= \sin^{-1}(0.2)$

$= 11.5^\circ$



$180 - 11.5 = 168.5^\circ$

$t = 11.5^\circ, 168.5^\circ$

13. (a) $SU = 3PR$

$x^2 + 5 = 3(2x)$

$x^2 + 5 = 6x$

$x^2 - 6x + 5 = 0$

(b) $x^2 - 6x + 5 = 0$

$(x - 1)(x - 5) = 0$

either $x - 1 = 0$ or $x - 5 = 0$

$x = 1$ $x = 5$

As QR is shortest side, $x = 5$ is only valid solution

2013 CREDIT MATHS PAPER 1 SOLUTIONS

1. $86.5 - 3.651 \times 20$

$= 86.5 - 73.02$

$= 13.48$

$36.51 \times 2 = 73.02$

$86.5 - 73.02 = 13.48$

2. $\frac{1}{2} \div 2\frac{2}{3}$

$= \frac{1}{2} \div \frac{8}{3}$

$= \frac{1}{2} \times \frac{3}{8}$

$= \frac{3}{16}$

3. Any two valid comments eg.

The mean number of cigarettes smoked per person per day dropped from 20.8 to 9.6 suggesting the course had a positive effect.

The standard deviation increased from 8.5 to 12.0 indicating a greater variation in the number of cigarettes smoked.

4. $A = 4\pi r^2$

$\frac{A}{4\pi} = r^2$

$r = \sqrt{\frac{A}{4\pi}}$

5. (a) $P(\text{male} \geq 60) = \frac{12}{150}$

$= \frac{2}{25}$

(b) $P(\leq 5) = \frac{7}{150}$

6. (a) $2g + 5s = 125$ ①

(b) $4g + 3s = 145$ ②

(c) $4g + 10s = 250$ ① × 2

$- \quad 4g + 3s = 145$ ②

$7s = 105$

$s = 15$

Sub $s = 15$ into ①

$2g + 5(15) = 125$

$2g + 75 = 125$

$2g = 50$

$g = 25$

check using ②

$4(25) + 3(15) = 145$

$100 + 45 = 145$

LHS ≡ RHS

A gold charm costs £25, silver charm is £15.

7. (a) $(2x-5)(x^2+3x-7)$

$= 2x(x^2+3x-7) - 5(x^2+3x-7)$

$= 2x^3 + 6x^2 - 14x - 5x^2 - 15x + 35$

$= 2x^3 + x^2 - 29x + 35$

(b) $4x - 5 \leq 7x - 20$

$-5 \leq 3x - 20$

$15 \leq 3x$

$5 \leq x$

$x \geq 5$

8. $2x + y = 3$

$y = -2x + 3$

↗ negative gradient

↖ positive y-intercept

$\Rightarrow$ matches graph D

9. (a) $12 \times 50p = £6$

$4 \times 35p = £1.40$

$CD = £4.25$

Total $= £11.65$

(b) $C = 0.5x + 6 + 4.25$

$C = 0.5x + 10.25$

10. (a) on x-axis $y = 0$

$\Rightarrow x^2 - 2x - 3 = 0$

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

either $x - 3 = 0$ or $x + 1 = 0$

$x = 3$ $x = -1$

$\Rightarrow A(-1, 0)$ & $B(3, 0)$

(b) $x = 1$ is axis of symmetry

11. (a) $9^2 - 8 \times 10 = 1$

(b) $(n+1)^2 - n(n+2)$

$= n^2 + 2n + 1 - n^2 - 2n$

$= 1$

PROVED

2013 CREDIT MATHS PAPER 2 SOLUTIONS

1. $D = 3\text{km}$
$= 3000\text{m}$

$S = \frac{D}{T}$ m/s

$T = 16$ days
$= (16 \times 24 \times 60 \times 60)$ seconds
$= 1\,382\,400$ s

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

$S = \frac{3000}{1382400}$

$S = 0.00217$

$S = 2.17 \times 10^{-3}$ m/s

2. $2x^2 + 7x - 3 = 0$

$a = 2 \quad b = 7 \quad c = -3$

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

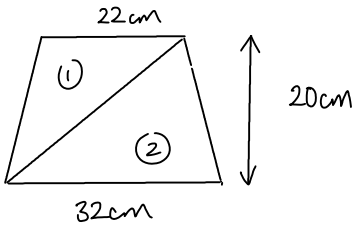
$$x = \frac{-(7) \pm \sqrt{(7)^2 - 4(2)(-3)}}{2(2)}$$

$$x = \frac{-7 \pm \sqrt{49 + 24}}{4}$$

$$x = \frac{-7 + \sqrt{73}}{4} \quad \text{or} \quad x = \frac{-7 - \sqrt{73}}{4}$$

$x = 0.4$ $\qquad$ $x = -3.9$

3. (a)



$A_① = \frac{1}{2}bh$
$= \frac{1}{2}(22)(20)$
$= 220\text{ cm}^2$

$A_② = \frac{1}{2}bh$
$= \frac{1}{2}(32)(20)$
$= 320\text{ cm}^2$

Total Area $= 540\text{ cm}^2$

(b) $V = Ah$

$V = 540 \times 60$

$V = 32\,400\text{ cm}^3$

4. $72\% = 1296$

$1\% = 1296 \div 72$

$= 18$

$28\% = 504$

504 people failed the test.

72% passed

$\Rightarrow$ 28% failed

5. $A = \frac{1}{2} ab \sin C$

$9 = \frac{1}{2} x . x . \sin 30$

$9 = \frac{1}{2} x^2 . \frac{1}{2}$

$9 = \frac{1}{4} x^2$

$x^2 = 36$

$x = 6$ cm

6. $r^2 = 19^2 - 18.2^2$

$r^2 = 361 - 331.24$

$r^2 = 29.76$

$r = \sqrt{29.76}$

$r = 5.46$ m

$C = \pi d$

$C = \pi \times 10.92$

$C = 34.3$m

7. $94 \times 0.93 = 87.42$

$87.42 \times 0.93 = 81.3$

$81.3 \times 0.93 = 75.6$

$75.6 \times 0.93 = 70.3$

$\Rightarrow$ He will reach his target during April.

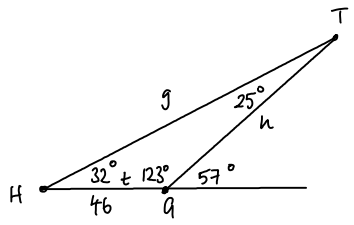
8. $\frac{x^\circ}{360^\circ} = \frac{\text{Arc AB}}{\pi d}$

$\frac{x^\circ}{360^\circ} = \frac{36.7}{\pi \times 100}$

$x^\circ = \frac{36.7}{100\pi} \times 360^\circ$

$x^\circ = 42^\circ$

9.

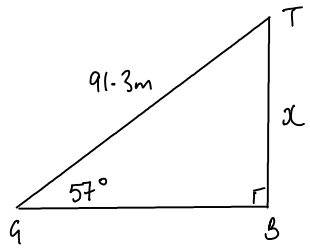


$\frac{g}{\sin G} = \frac{h}{\sin H} = \frac{t}{\sin T}$ ✓

$\frac{g}{\sin G} = \frac{t}{\sin T}$

$g = \frac{46 \sin 123^\circ}{\sin 25^\circ}$

$g = 91.3$ m



$\sin x^\circ = \frac{\text{opp}}{\text{hyp}}$

$\sin 57^\circ = \frac{x}{91.3}$

$x = 91.3 \sin 57^\circ$

$x = 76.6$

$TP = 76.6$m

10. (a) $f(x) = 4 \times 2^x$

$f(3) = 4 \times 2^3$

$= 4 \times 8$

$= 32$

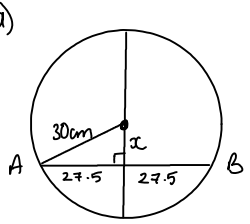
(b) $f(m) = 4$

$4 \times 2^m = 4$

$2^m = 1$

$m = 0$

11. (a)



$x^2 = 30^2 - 27.5^2$

$x^2 = 900 - 756.25$

$x^2 = 143.75$

$x = \sqrt{143.75}$

$x = 12.0\text{ cm}$ to 1 d.p.

Depth $= 30 - 12$

$= 18\text{ cm}$

(b) $60 - 18 = 42\text{ cm}$

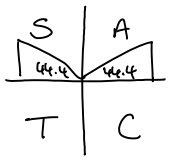
(water 18cm from top)

12. $1 + \sin x^\circ = 1.7$

$\sin x^\circ = 0.7$

acute angle $= \sin^{-1}(0.7)$

$= 44.4^\circ$



$180^\circ - 44.4^\circ = 135.6^\circ$

$x^\circ = 44.4^\circ, 135.6^\circ$

$x_A = 44.4^\circ \quad x_B = 135.6^\circ$

13. Card width $= 35\text{ cm}$

S.F. (enlargement) $= \frac{35}{25}$

$= \frac{7}{5}$

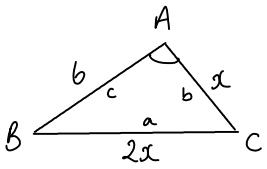
Card length $= \frac{7}{5} \times 40$

$= 56\text{ cm}$

$56 = 40 + 5 + x$

$x = 11\text{ cm}$

14.



$\cos A = 0.5$

$a^2 = b^2 + c^2 - 2bc\cos A$

$(2x)^2 = x^2 + (6)^2 - 2x.(6)(0.5)$

$4x^2 = x^2 + 36 - 6x$

$3x^2 + 6x - 36 = 0$

$x^2 + 2x - 12 = 0$

2014 – Paper 1

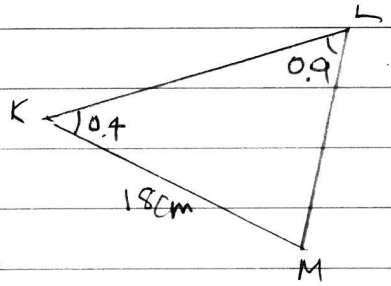
1. $\frac{5}{\cancel{12}_{3}} \times \frac{\cancel{20}^{5}}{9} = \frac{25}{27}$

2. $(2x-5)(3x+1)$
$= 6x^2 + 2x - 15x - 5$
$= 6x^2 - 13x - 5$

3. $x^2 - 14x + 44$
$= (x-7)^2 - 49 + 44$
$= (x-7)^2 - 5$

4. $2\underset{\sim}{u} = 2\begin{pmatrix} -2 \\ 3 \\ 5 \end{pmatrix}$ $\quad 2\underset{\sim}{u} - \underset{\sim}{v} = \begin{pmatrix} -4 \\ 6 \\ 10 \end{pmatrix} - \begin{pmatrix} 0 \\ -4 \\ 7 \end{pmatrix} = \begin{pmatrix} -4 \\ 10 \\ 3 \end{pmatrix}$

5.



$\frac{LM}{0.4} = \frac{18}{0.9}$

$\frac{LM}{4/10} = \frac{18}{9/10}$

$\frac{10LM}{4} = \frac{180}{9}$

$\frac{5LM}{2} = 20$

$50LM = 40$

$LM = 8\,cm$

6. $A(5, 200)$ $\quad B(25, 500)$

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{500 - 200}{25 - 5} = \frac{300}{20} = 15$

$y = mx + c$

$y = 15x + c$

sub (5, 200)

$200 = 15(5) + C$

$200 = 75 + C$ $\quad \therefore y = 15x + 125$

$C = 125$ $\quad C = 15F + 125$

b) $C = 15(40) + 125$

$= 600 + 125 = 725$ calories

7. $y = ax^2$

$45 = a(-3)^2$

$45 = 9a$

$a = 5$

8. $\sqrt{40} + 4\sqrt{10} + \sqrt{90}$

$= \sqrt{4 \times 10} + 4\sqrt{10} + \sqrt{9 \times 10}$

$= 2\sqrt{10} + 4\sqrt{10} + 3\sqrt{10} = 9\sqrt{10}$

9. $80\% = 480000$

$10\% = 60000$

$\times 10 = 600000$ tickets

10. $y = 3\sin(x - 40)$ $\quad \therefore a = 3 \quad b = -40.$

11. $4x + 3y = 12$

$3y = -4x + 12$

$y = -\frac{4}{3}x + 4$ $\quad m = -\frac{4}{3}$

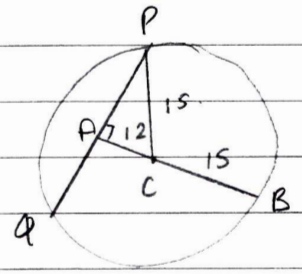
b) Crosses x-axis when $y = 0$

$0 = -4x + 12$

$4x = 12$

$x = 3$ $\quad (3, 0)$

12.



$AP^2 = 15^2 - 12^2$

$= 225 - 144$

$AP = \sqrt{81} = 9$

$225 - 144 = 81$

$PQ = 9 \times 2 = 18cm$

13. $h(t) = 16t - t^2$

$60 = 16t - t^2$

$t^2 - 16t + 60 = 0$

$(t - 6)(t - 10) = 0$

$t = 6 \quad t = 10$ first at 6 seconds.

b) peaks at $t = 8$ (axis of symmetry)

$h(8) = 16(8) - 8^2$

$= 128 - 64$

$= 64m.$

$16 \times 8 = 128$

No it wont as the max height it reaches is 64m.

2014 - Paper 11

1. $100 - 15 = 85$ $\quad (0.85)^3 \times 964 = 592.02$

$= 590$ pupils

2. B(8, 4, 10)
C(4, 0, 10)

3. a) let a = adult ticket and c = child's ticket

$5a + 3c = 158.25$

b) $3a + 2c = 98$

c) $5a + 3c = 158.25$ — $\times 2$

$3a + 2c = 98$ — $\times 3$

$10a + 6c = 316.5$

$-\ 9a + 6c = 294$

$a = 22.5$

$3(22.5) + 2c = 98$

$2c = 98 - 67.5 = 30.5$

$c = 15.25$

Adult ticket costs £22.50
Child ticket costs £15.25

4. a) i) $\bar{x} = \frac{339}{6} = 56.5$

ii)

x	$x - \bar{x}$	$(x - \bar{x})^2$
53	−3.5	12.25
57	0.5	0.25
58	1.5	2.25
60	3.5	12.25
55	−1.5	2.25
56	−0.5	0.25
$n = 6$		29.5

$s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}}$

$= \sqrt{\frac{29.5}{5}} = \sqrt{5.9} = 2.43$

$= 2.4$

b) No it hasn't : at 3.2 > 2.4 secs shows the results are more spread out now so she's less consistent.

5 $SF = \frac{24}{15} = \frac{8}{5}$

Vol SF $= \left(\frac{8}{5}\right)^3 = \frac{512}{125}$.

Vol of larger jar $\Rightarrow \frac{512}{125} \times 750 = 3072\ cm^3$

6. If Hightown is directly north of Lowtown then by Pythagoras
$110^2 = 75^2 + 85^2$ — check
$110^2 = 12100$
$75^2 + 85^2 = 5625 + 7225 = 12850$
$110^2 \neq 75^2 + 85^2$
∴ by Pythagoras it is not directly north.

7. Vol of cone $= \frac{1}{3}\pi r^2 h$
$= \frac{1}{3} \times \pi \times 4^2 \times 15$
$= 251.3274$

Vol of sphere $= \frac{4}{3}\pi r^3$
$= \frac{4}{3} \times \pi \times 3.7^3$
$= 212.2$

hemisph $= 106.09$

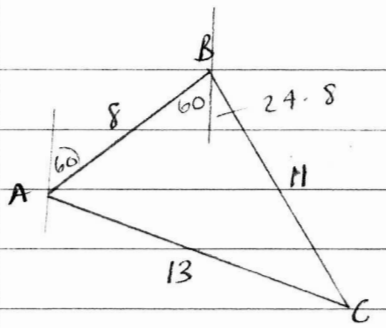
Vol of glass : $251.3 - 106.09 = 145.24$
$= 150\ cm^3$

8. $\frac{n^5 \times 10n}{2n^2} = \frac{10n^6}{2n^2} = 5n^4$

9. $\frac{7}{x+5} - \frac{3}{x} = \frac{7x}{x(x+5)} - \frac{3(x+5)}{x(x+5)}$

$= \frac{7x - 3x - 15}{x(x+5)} = \frac{4x - 15}{x(x+5)}$

10.



$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$= \frac{8^2 + 11^2 - 13^2}{2 \times 8 \times 11} = \frac{16}{176} = \frac{1}{11}$$

$$B = \cos^{-1}\left(\frac{1}{11}\right) = 84 \cdot 8^\circ$$

b) $180 - 24 \cdot 8 = 155 \cdot 2^\circ$

11. $s = ut + \frac{1}{2}at^2$

$$s - ut = \frac{1}{2}at^2$$

$$2(s - ut) = at^2$$

$$a = \frac{2(s - ut)}{t^2}$$

12. $11\cos x - 2 = 3$

$$11\cos x = 5$$

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

S A
T C

360 − α

$$x = \cos^{-1}\left(\frac{5}{11}\right) = 62 \cdot 96^\circ, \quad 360 - 62 \cdot 96$$

$$= 62 \cdot 96^\circ, \quad 297^\circ$$

13. Area of $\Delta = \frac{1}{2}ab\sin C$

$$= \frac{1}{2} \times 7 \times 7 \times \sin 50$$

$$= 18 \cdot 8$$

Area of sector $= \frac{50}{360} \times \pi \times 7^2$

$$= 21 \cdot 38$$

Area of $O = \pi r^2$

$$= \pi \times 7^2$$

$$= 153 \cdot 9$$

Area of cross section $= 153 \cdot 9 - 21 \cdot 38 + 18 \cdot 8$

$$= 151 \cdot 3 \text{ m}^2$$

NAT 5 2015

Paper 1

Q1) $6\frac{1}{5} - 2\frac{1}{3}$

$= \frac{31}{5} - \frac{7}{3}$

$= \frac{93-35}{15}$ ✓

$= \frac{58}{15}$

$= 3\frac{13}{15}$ ✓

Q2) $11 - 2(1+3x) < 39$

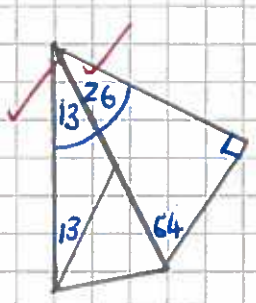
$11 - 2 - 6x < 39$ ✓

$9 - 6x < 39$

$-6x < 30$ ✓

$x > -5$ ✓

Q3)



✓

$B\hat{D}F = 13 + 26 = 39°$ ✓

Q4) $(x-4)(x^2+x-2)$ ✓

$= x^3 + x^2 - 2x - 4x^2 - 4x + 8$ ✓

$= x^3 - 3x^2 - 6x + 8$ ✓

Q5)

x	$x-\bar{x}$	$(x-\bar{x})^2$
1	-2	4
2	-1	1
2	-1	1
2	-1	1
8	5	25
		32

$\bar{x} = \frac{8+2+2+2+1}{5}$

$= \frac{15}{5} = 3$

$SD = \sqrt{\frac{32}{5-1}}$

$= \sqrt{\frac{32}{4}}$

$= \sqrt{8}$

$\Rightarrow a = 8$

Q6) $y = a\sin bx$ $\quad a=4,\ b=3 \Rightarrow y = 4\sin 3x$

Q7) a) $y = (x+a)^2 + b$

$y = (x-2)^2 - 4$

(i) $a = -2$ $\quad$ (ii) $b = -4$

b) $x = 2$

Q8) $(-2, 5)$ $\quad (3, 15)$

x_1, y_1 $\quad x_2, y_2$

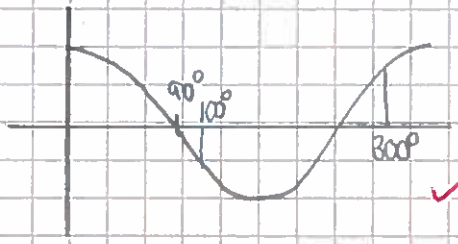
$m = \frac{15-5}{3+2} = \frac{10}{5} = 2$

$y - 5 = 2(x+2)$

$y - 5 = 2x + 4$

$y = 2x + 9$

Q9)



$\cos 100°, \cos 90°, \cos 300°$

Q10) a) 12 16 17 18 18 21 22 26 27 27

Median $= \frac{18+21}{2} = \frac{39}{2} = 19.5$ ✓

Lower Quartile = 17

Upper Quartile = 26 ✓

Inter Quartile Range = 26 − 17 = 9

Semi Inter Quartile Range = 9 ÷ 2 = 4.5 ✓

b) median = 26 SIQR = 2.5

Their average score was significantly higher in the second week ✓

&

✓

Their scores were less varied as their SIQR = 2.5 < 4.5. So marks are more closely grouped around the median. (are more consistent)

Q11) $3x + 2y = 17$ ①

$2x + 5y = 4$ ②

$5 \times$ ① $\quad 15x + 10y = 85$

$-2 \times$ ② $\quad -4x - 10y = -8$ ⊕ ✓

$11x = 77$

$x = 7$

Input $x = 7$ into ② ✓

$14 + 5y = 4$

$5y = -10$

$y = -2$

$x = 7, y = -2$ ✓

(Q12) $\dfrac{x^2-4x}{x^2+x-20}$

$= \dfrac{x(x-4)}{(x+5)(x-4)}$ ✓ ✓

$= \dfrac{x}{x+5}$ ✓

(Q13) $\dfrac{4}{\sqrt{8}} \times \dfrac{\sqrt{8}}{\sqrt{8}}$

$= \dfrac{4\sqrt{8}}{8}$ ✓

$= \dfrac{\sqrt{4\times 2}}{2}$

$= \dfrac{2\sqrt{2}}{2}$ ✓

$= \sqrt{2}$ ✓

(Q14) $8^{5/3}$

$= \left(\sqrt[3]{8}\right)^5$ ✓

$= 2^5$

$= 32$ ✓

NAT 5 2015
Paper 2

Q1) $100 + 2{\cdot}8 = 102{\cdot}8\%$

$240000 \times 1{\cdot}028^2$ ✓✓

$= £253628{\cdot}16$ ✓

Q2) $f(x) = 3x + 2$

$f(a) = 23$

$3a + 2 = 23$ ✓

$3a = 21$

$a = 7$ ✓

Q3) $a^2 = b^2 + c^2 - 2bc\cos A$ ✓

$AB^2 = 1{\cdot}2^2 + 1{\cdot}35^2 - 2 \times 1{\cdot}2 \times 1{\cdot}35 \times \cos 35$

$AB^2 = 0{\cdot}608447\ldots$ ✓

$AB = \sqrt{0{\cdot}608447\ldots}$

$= 0{\cdot}78003\ldots$

$= 0{\cdot}78$ km (2dp) ✓

Q4) $|\underline{u}| = \sqrt{6^2 + (-13)^2 + 18^2}$ ✓

$= \sqrt{529}$ ✓

$= 23$ units long

Q5) $\underline{p} = -5\underline{i} + 3\underline{j} = \begin{pmatrix} -5 \\ 3 \end{pmatrix}$ $\underline{q} = 4\underline{i} - 5\underline{j} = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$ ✓

$\underline{p} + \underline{q} = -\underline{i} - 2\underline{j} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$ ✓

Q6) a) $r = 6400\text{km}$

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

$= \frac{4}{3} \times \pi \times 6400^3$ ✓

$= 1.09806\ldots \times 10^{12}$ ✓

$= 1.1 \times 10^{12}\ \text{km}^3$ (2sf) ✓

b) $V_{moon} = 2.2 \times 10^{10}$

$V_{earth} \div V_{moon}$

$= (1.1 \times 10^{12}) \div (2.2 \times 10^{10})$ ✓

$= 0.5 \times 10^2$

$= 50$

$\approx$ 50 times bigger ✓ (nearest whole no.)

Q7) $\frac{5t}{s} \div \frac{t}{2s^2}$

$= \frac{5t}{s} \times \frac{2s^2}{t}$ ✓✓

$= 10s$ ✓

Q8) 85% = 297.50 ✓

÷85 1% = 3.5 ✓

100% = £350 ✓

is the original price

Q9) $SF = \frac{30}{24} = 1.25$ ✓

$AF = 1.25^2 = 1.5625$

Area PSR $= 1.5625 \times 400$ ✓

$= 625\text{cm}^2$ ✓

Blue Area PQTS $= 625 - 400$

$= 225\text{cm}^2$ ✓

(Q10) Arc = 28·4 cm Angle = 65°

$$\text{Arc} = \frac{\text{Angle}}{360} \times \pi \times d$$

$$28{\cdot}4 = \frac{65}{360} \times \pi \times d$$

$$\frac{28{\cdot}4 \times 360}{65 \times \pi} = d$$

$$d = 50{\cdot}0676\ldots$$

Length of pendulum = 50·0676... ÷ 2

= 25·0338...

= 25·03 cm (2dp)

(Q11) Angle at centre = 360 ÷ 6 = 60

Area of one triangle = $\frac{1}{2} \times 20 \times 20 \times \sin 60$

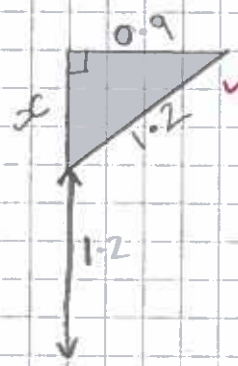
= 173·2050...

Total Area = 173·2050... × 6

= 1039·2304...

= 1039·23 cm² (2dp)

(Q12)



$b^2 = h^2 - a^2$

$x^2 = 1{\cdot}2^2 - 0{\cdot}9^2$

$x^2 = 0{\cdot}63$

$x = \sqrt{0{\cdot}63}$

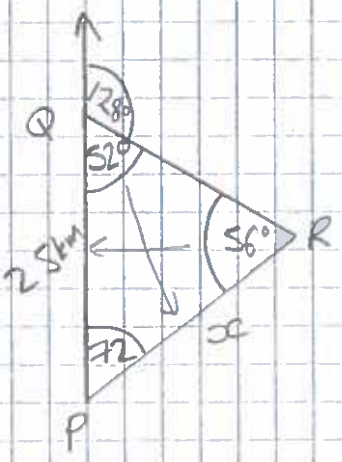
$= 0{\cdot}7937\ldots$

Total Depth = 1·2 + 0·7937...

= 1·9937...

= 1·99 m (2dp)

Q13)



$180 - 128 = 52°$ ✓

$180 - 52 - 72 = 56°$

$\frac{x}{\sin 52} = \frac{25}{\sin 56}$ ✓

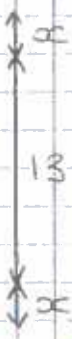
$x = \frac{25 \times \sin 52}{\sin 56}$ ✓

$= 23.7628...$

$= 23.76$ km (2dp) ✓

Q14

a)



length of card $= 13 + 2x$ ✓

width of card $= 9 + 2x$

b) Area Card = Large rectangle

$270 = (13+2x)(9+2x)$

$270 = 117 + 26x + 18x + 4x^2$ ✓

$4x^2 + 44x + 177 - 270 = 0$

$4x^2 + 44x - 153 = 0$ ✓

c)

4	−153	−1	51	−3	17	−9
x	1	−153	−3	51	−9	17

$a = 4,\ b = 44,\ c = -153$

$x = \frac{-4 \pm \sqrt{44^2 + 2448}}{8}$

$= \frac{-4 \pm \sqrt{4384}}{8}$

$= 7.7764...$ or $-8.7764...$

x cannot be a negative length

$\therefore x = 7.8$ cm (1dp)

National 5 2016 PAPER 1

1) $p = \begin{pmatrix} 4 \\ -6 \end{pmatrix}$ $q = \begin{pmatrix} -5 \\ -1 \end{pmatrix}$

$\frac{1}{2}p + q = \begin{pmatrix} 2 \\ -3 \end{pmatrix} + \begin{pmatrix} -5 \\ -1 \end{pmatrix} = \begin{pmatrix} -3 \\ -4 \end{pmatrix}$

2) $\frac{3}{4}\left(\frac{1}{3} + \frac{2}{7}\right)$

$= \frac{3}{4}\left(\frac{7+6}{21}\right)$

$= \frac{\cancel{3}}{4} \times \frac{13}{\cancel{21}_{7}} = \frac{13}{28}$

3) Area $= \frac{x}{360} \times \pi r^2$

$= \frac{45}{360} \times 3.14 \times 20^2$

$= \frac{1}{8} \times 3.14 \times 400$

$8\overline{)400} = 50$

$= 50 \times 3.14$

$3.14 \times 5 = 15.70$ (×10)

$= 157\,cm^2$

4) a) $2c + 3d = 9.6$ ①

b) $3c + 4d = 13.3$ ②

c) ①×3 $6c + 9d = 28.8$ −

②×2 $-6c - 8d = -26.6$

$d = 2.2$

$9.6 \times 3 = 28.8$

Input $d = 2.2$ into ①

$2c + 6.6 = 9.6$

$2c = 3$

$c = 1.5$

1 dress → $2.2m^2$

1 cloak → $1.5m^2$

5) D(3,100) E(15,340)

a) $m = \frac{340-100}{15-3}$

$= \frac{240}{12} = 20$

$y - b = m(x - a)$

$y - 100 = 20(x - 3)$

$y - 100 = 20x - 60$

$y = 20x + 40$

$W = 20A + 40$

b) 1yr old ⇒ $A = 12$

$W = 20 \times 12 + 40$

$= 240 + 40$

$= 280kg$

6) $f(x) = 7x^2 + 5x - 1$

$a = 7,\ b = 5,\ c = -1$

$b^2 - 4ac = 25 + 28$

$= 53$

$53 > 0$

⇒ Roots are real & distinct.

7) a) B(8, 4, 0)

b) $\overrightarrow{V-A} = \begin{pmatrix} 5 \\ 2 \\ 6 \end{pmatrix} - \begin{pmatrix} 2 \\ 0 \\ 0 \end{pmatrix}$

$= \begin{pmatrix} 3 \\ 2 \\ 6 \end{pmatrix}$

$|V-A| = \sqrt{9+4+36}$

$= \sqrt{49}$

$= 7$

8) $\frac{2x}{3} - \frac{5}{6} = 2x$

(×6)

$4x - 5 = 12x$

$-5 = 8x$

$x = -\frac{5}{8}$

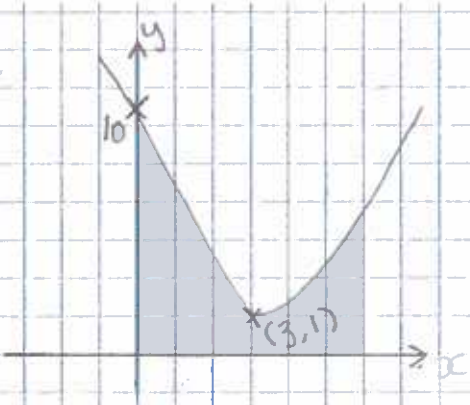
9) $f(x) = \frac{2}{\sqrt{x}}$

$f(5) = \frac{2}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$

$= \frac{2\sqrt{5}}{5}$

10) $y = (x-3)^2 + 1$

TP (3, 1)



y axis $x = 0$ $y = (-3)^2 + 1$

$= 10$

(0, 10)

11) $\tan^2 x \cos^2 x$

$= \frac{\sin^2 x}{\cos^2 x} \times \cos^2 x$

$= \sin^2 x$

12) a) $A_{REC} = (2x+1)(x+8)$

$= 2x^2 + 17x + 8$

b) $A_{TRI} = \frac{1}{2} \times (3x) \times 2(x+5)$

$= 3x(x+5)$

$= 3x^2 + 15x$

$A_{TRI} = A_{REC}$

$3x^2 + 15x = 2x^2 + 17x + 8$

$x^2 - 2x - 8 = 0$

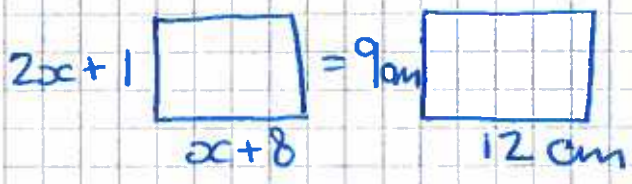
c) Factorise

$(x-4)(x+2) = 0$

$x = 4, x = -2$

x cannot be negative as gives invalid dimensions

$\therefore x = 4$



National 5 2016 PAPER 2

1) $35 \times (0.92)^3$

$= 27.2540...$

$= 27.25\ g$ (2dp)

2) $12 \times (1.5 \times 10^9)$

$= 1.8 \times 10^{10}\ g$

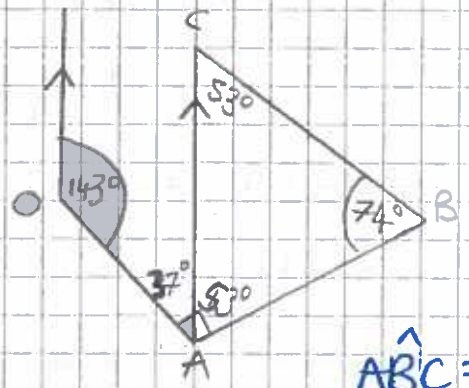
3) $\overrightarrow{BD} = \underline{v} - \underline{u}$

4) $3x^2 - 48$

$= 3(x^2 - 16)$

$= 3(x+4)(x-4)$

5)



$180 - 143 = 37°$

$90 - 37 = 53°$

$180 - 53 - 53 = 74°$

$A\hat{B}C = 74°$

6) a) $\bar{x} = \frac{78}{6} = 13$ mins

x	$x - \bar{x}$	$(x - \bar{x})^2$
5	−8	64
10	−3	9
12	−1	1
13	0	0
16	3	9
22	9	81
		164

$SD = \sqrt{\frac{164}{6-1}}$

$= \sqrt{32.8} = 5.727...$

$= 5.72$ (2dp) mins

b) $\bar{x}_2 = 5$ min $SD_2 = 4.3$ min

On average Sophie had to wait longer to speak to an advisor ($15 > 13$)

However, Jack's waiting times were less consistent than Sophies ($5.72 > 4.3$)

7) $V_{BIG} = \frac{1}{3} \times \pi \times 16^2 \times 24$

$= 6433.98175...$

$V_{SMALL} = \frac{1}{3} \times \pi \times 9^2 \times 13.5$

$= 1145.1105...$

$V_{BIG} - V_{SMALL} = 5288.8712$

$= 5300\ cm^3$ (2sf)

8) $\frac{\sin x}{150} = \frac{\sin 66}{140}$

$x = \sin^{-1}\left(\frac{\sin 66}{140} \times 150\right)$

$x = 78.180\ldots$

$= 78.18°$ (2dp)

9) $x^2+8x-7 = (x+4)^2-7-16$

$= (x+4)^2-23$

10) $(n^2)^3 \times n^{-10}$

$= n^6 \times n^{-10} = n^{-4} = \frac{1}{n^4}$

11) $k = \frac{60}{100} = 0.6$

Area factor $k^2 = 0.6^2 = 0.36$

$13.75 \times 0.36 = £4.95$

12) $L = \sqrt{4kt-p}$

$L^2 = 4kt - p$

$L^2 + p = 4tk$

$k = \frac{L^2+p}{4t}$

13) $\frac{3}{x-2} + \frac{5}{x+1}$

$= \frac{3(x+1)+5(x-2)}{(x-2)(x+1)}$

$= \frac{3x+3+5x-10}{(x-2)(x+1)}$

$= \frac{8x-7}{(x-2)(x+1)}$

14) $2\tan x + 5 = -4$

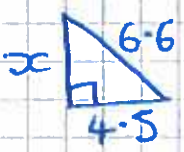
$2\tan x = -9$

$\tan x = -4.5$

S ✓	A
T	C ✓

$\tan^{-1}(4.5) = 77.47$ (2dp)

$x = 102.53°, 282.53°$ (2dp)

15) 

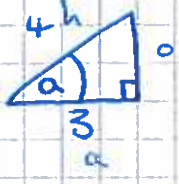
$x^2 = 6.6^2 - 4.5^2$

$x = \sqrt{23.31}$

$x = 4.83$ cm (2dp)

height $= 6.6 + 4.83$

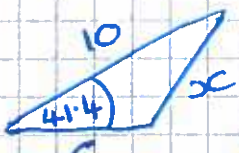
$= 11.43$cm (2dp)

16) 

$\cos a = \frac{3}{4}$

$a = \cos^{-1}\left(\frac{3}{4}\right)$

$a = 41.4096°$



Cosine rule

$x^2 = 10^2 + 6^2 - 2\times10\times6\times\cos 41.4$

$x^2 = 100 + 36 - 120 \times 0.75$

$x^2 = 46$

$x = \sqrt{46}$

$= 6.78\ldots = 6.8$cm (1dp)

National 5 Mathematics
2017 Exam - Paper 1
Worked Solutions

1. $f(x) = x^2 + 3x$

$f(-5) = (-5)^2 + 3 \times (-5)$

$f(-5) = 25 - 15$

$f(-5) = 10$ **2**

2. Lower quartile $(Q_1) = 218$ Upper quartile (Q_3) 250

$$\text{S.I.Q.R.} = \frac{250 - 218}{2}$$

$$\text{S.I.Q.R.} = \frac{32}{2}$$

$\text{S.I.Q.R.} = 16$ **2**

3. $1\frac{5}{6} \div \frac{3}{4}$

$= \frac{11}{6} \div \frac{3}{4}$

$= \frac{11}{6} \times \frac{4}{3}$

$= \frac{44}{18}$

$= \frac{22}{9}$

$= 2\frac{4}{9}$ **2**

4. $(2x + 3)(x^2 - 4x + 1)$

$= 2x^3 - 8x^2 + 2x + 3x^2 - 12x + 3$

$= 2x^3 - 5x^2 - 10x + 3$ **3**

A J McLean, 2017

5. $B(0,6,6)$ $C(3,3,9)$ **2**

6. $m = \dfrac{-2-6}{3-(-1)}$

$m = \dfrac{-8}{4}$

$m = -2$

$y - b = m(x-a)$

$y - 6 = -2(x-(-1))$

$y - 6 = -2(x+1)$

$y - 6 = -2x - 2$

$y = -2x + 4$

or

$y = mx + c$

$6 = -2\times(-1) + c$

$6 = 2 + c$

$c = 4$

$y = -2x + 4$ **3**

7. $\text{Area} = \dfrac{1}{2}ab\sin C$

$\text{Area} = \dfrac{1}{2}df\sin E$

$\text{Area} = \dfrac{1}{2}\times 12\times 8\times \dfrac{2}{3}$

$\text{Area} = 6\times 8\times \dfrac{2}{3}$

$\text{Area} = 4\times 8$

$\text{Area} = 32 \text{ cm}^2$ **2**

8. $19 + x > 15 + 3(x-2)$

$19 + x > 15 + 3x - 6$

$19 + x > 9 + 3x$

$19 - 9 > 3x - x$

$10 > 2x$

$5 > x$

$x < 5$ **3**

9. $\angle OBE = 90°$

$\angle OBD = 90 - 58 = 32°$

$\angle ODB = 32°$

$\angle BOD = 180 - 32 - 32 = 116°$

$\angle COB = 180 - 116 = 64°$

$\angle ABO = 90°$

$\angle CAB = 180 - 90 - 64 = 26°$ **3**

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10.

$$F = \frac{t^2 + 4b}{c}$$

$$\frac{t^2 + 4b}{c} = F$$

$$t^2 + 4b = Fc$$

$$4b = Fc - t^2$$

$$b = \frac{Fc - t^2}{4}$$

3

11.

$$\frac{3}{a^2} - \frac{2}{a}$$

$$= \frac{3}{a^2} - \frac{2a}{a^2}$$

$$= \frac{3 - 2a}{a^2}$$

2

12.

$$\bar{x} = \frac{20}{5}$$

$$\bar{x} = 4$$

x	$x - \bar{x}$	$\left(x - \bar{x}\right)^2$
1	–3	9
4	0	0
6	2	4
3	–1	1
6	2	4
Totals	0	18

$$\text{s.d.} = \sqrt{\frac{18}{4}}$$

$$\text{s.d.} = \frac{\sqrt{18}}{\sqrt{4}}$$

$$\text{s.d.} = \frac{\sqrt{9 \times 2}}{2}$$

$$\text{s.d.} = \frac{3\sqrt{2}}{2}$$

4

13.

$$3x - y = 2 \quad (\times 3)$$

$$x + 3y = 19$$

$$9x - 3y = 6$$

$$x + 3y = 19 \quad (+)$$

$$10x = 25$$

$$x = 2.5$$

$$3x - y = 2$$

$$3 \times 2.5 - y = 2$$

$$7.5 - y = 2$$

$$y = 7.5 - 2$$

$$y = 5.5$$

$$\text{P}(2.5,\ 5.5)$$

3

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14a. $a = 5$ **1**

14b. $y = (x + a)^2 + b$

$8 = (-3 + 5)^2 + b$

$8 = 2^2 + b$

$8 = 4 + b$

$b = 4$ **2**

15. Enlarging linear scale factor $= \frac{7}{5}$

$\frac{7}{5}x = x + 2.6$

$7x = 5x + 13$

$2x = 13$

$x = 6.5$ **3**

[END OF WORKED SOLUTIONS]

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National 5 Mathematics
2017 Exam - Paper 2
Worked Solutions

1.

$$|\underline{v}| = \sqrt{18^2 + (-14)^2 + 3^2}$$
$$|\underline{v}| = \sqrt{529}$$
$$|\underline{v}| = 23$$

2

2.

$$1200 \times 1.045^3$$
$$= £1369.40$$
$$= £1369 \text{ to the nearest pound}$$

3

3.

$$QR^2 = PQ^2 + PR^2 - 2 \times PQ \times PR \times \cos P$$
$$QR^2 = 250^2 + 180^2 - 2 \times 250 \times 180 \times \cos 147°$$
$$QR^2 = 170380.3511$$
$$QR = \sqrt{170380.3511}$$
$$QR = 412.77 \text{ m}$$

3

4.

$$x = \frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times (-4)}}{2 \times 2}$$
$$x = \frac{-5 \pm \sqrt{25 + 32}}{4}$$
$$x = \frac{-5 \pm \sqrt{57}}{4}$$
$$x = -3.137,\ 0.637$$
$$x = -3.1,\ 0.6 \text{ to 1 decimal place}$$

3

5.

$$115\% = 4830$$
$$1\% = 4830 \div 115 = 42$$
$$100\% = 42 \times 100 = 4200 \text{ tickets}$$

3

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6. Whole sweet

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

$V = \frac{4}{3} \times \pi \times 12^3$

$V = 7238.23 \text{ mm}^3$

Caramel

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

$V = \frac{4}{3} \times \pi \times 9^3$

$V = 3053.63 \text{ mm}^3$

Chocolate

$V = 7238.23 - 3053.63$

$V = 4184.60$

$V = 4180 \text{ mm}^3$ to 3 significant figures **5**

7. Larger triangle has sides 8 cm, 19 cm and 22 cm.

If the larger triangle is right-angled, $8^2 + 19^2$ must equal 22^2.

$8^2 + 19^2 = 425 \neq 22^2 \quad 484$

As $425 \neq 484$ the larger triangle is not right-angled. **3**

8a. $\overrightarrow{PR} = \underline{d} - \underline{c}$ **1**

8b. $\overrightarrow{TV} = \overrightarrow{TP} + \overrightarrow{PV}$

$\overrightarrow{TV} = -\underline{d} \quad \frac{1}{2}(\underline{d} \quad \underline{c})$

$\overrightarrow{TV} = \underline{d} + \frac{1}{2}\underline{d} - \frac{1}{2}\underline{c}$

$\overrightarrow{TV} = \frac{3}{2}\underline{d} - \frac{1}{2}\underline{c}$ **2**

9a. $4x^2 - 25$

$= (2x + 5)(2x - 5)$ **1**

9b. $\frac{4x^2 - 25}{2x^2 - x - 10}$

$= \frac{(2x + 5)\cancel{(2x - 5)}}{\cancel{(2x - 5)}(x + 2)}$

$= \frac{2x + 5}{x + 2}$ **3**

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10. $\angle EDF = 126 - 90 = 36°$

$\angle DEF = 270 - 230 = 40°$

$\angle DFE = 180 - 36 - 40 = 104°$

$$\frac{DF}{\sin E} = \frac{DE}{\sin F}$$

$$\frac{DF}{\sin 40°} = \frac{15}{\sin 104°}$$

$$DF = \frac{15\sin 40°}{\sin 104°}$$

$$DF = 9.94 \text{ km}$$

4

11. $3x - 5y - 10 = 0$

$3x - 10 = 5y$

$5y = 3x - 10$

$$y = \frac{3}{5}x - 2$$

$$m = \frac{3}{5}$$

2

12. $$\frac{1}{\sqrt[3]{x}}$$

$$= \frac{1}{x^{\frac{1}{3}}}$$

$$= x^{-\frac{1}{3}}$$

2

13. $48 \div 4 = 12$

$a^2 = 14^2 - 12^2$

$a^2 = 52$

$a = \sqrt{52}$

$a = 7.2 \text{ cm}$

$h = 2(7.2 + 14)$

$h = 42.4 \text{ cm}$

4

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14.
$$\frac{\text{Angle}}{360} = \frac{\text{Arc length}}{\text{Circumference}}$$
$$\frac{\angle AOB}{360} = \frac{31.5}{12.8\pi}$$
$$\angle AOB = \frac{31.5 \times 360}{12.8\pi}$$
$$\angle AOB = 282° \quad \textbf{3}$$

15a. $h = 40 - 23\cos 60°$
$h = 51.5 \text{ m}$ **1**

15b. Minimum value of $\cos x$ is -1
$\therefore$ Minimum value of $h = 40 + 23 \times (-1) = 17 \text{ m}$ **1**

15c.
$$40 + 23\cos x° = 61$$
$$23\cos x° = 61 - 40$$
$$23\cos x° = 21$$
$$\cos x° = \frac{21}{23}$$
$$x° = 24°,\ 360 - 24$$
$$x° = 24°,\ 336° \quad \textbf{4}$$

[END OF WORKED SOLUTIONS]

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