CREDIT 2001 – Paper I

1. $3.1 + 2.6 \times 4$
   $3.1 + 10.4$
   13.5

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2. $3\frac{5}{8} + 4\frac{2}{3}$

   Add whole number parts: $7 + \frac{5}{8} + \frac{2}{3}$

   Use common denominator of 24

   $7 + \frac{15}{24} + \frac{16}{24} \rightarrow 7 + \frac{31}{24} \rightarrow 7 + 1\frac{7}{24}$

   $\rightarrow 8\frac{7}{24}$

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3. $f(m) = m^2 - 3m$

   $f(-5) = (-5)^2 - 3(-5)$

   $f(-5) = 25 + 15 \quad \Rightarrow \quad 40$

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4. $2x - \frac{(3x-1)}{4} = 4$

   Multiply throughout by 4; carefully!!

   $8x - (3x - 1) = 16$

   Simplify $8x - 3x + 1 = 16$

   $5x + 1 = 16$ subtract 1 from each side

   $5x = 15$ divide both sides by 3

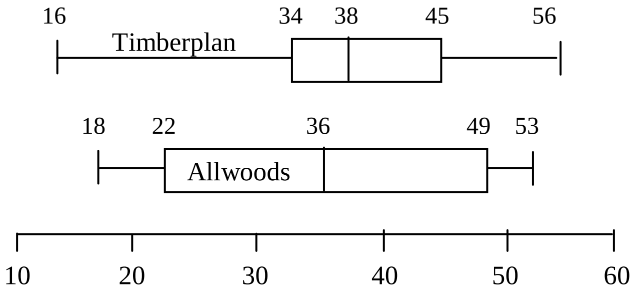
   $x = 3$

---

5. This table is a five figure summary for each supplier.

Company	*Minimum*	*Maximum*	*Lower Quartile*	*Median*	*Upper Quartile*
Timberplan	16	56	34	38	45
Allwoods	18	53	22	36	49

a) Draw box plots



5b). The interquartile range of Timberplan is much lower than that of Allwoods, hence they are more consistent in their deliveries.

So use **Timberplan**

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6. A is the point (a^2, a)

   T is the point (t^2, t) $a \neq t$

   Gradient = $\frac{\text{Rise}}{\text{Run}} = \frac{\text{Change in } y}{\text{Change in } x}$

   Change in y: $a - t$

   Change in x: $a^2 - t^2$

   Gradient = $\frac{a-t}{a^2-t^2}$

   Note that $a^2 - t^2$ is difference of 2 squares

   i.e. $(a+t)(a-t)$

   So, Gradient = $\frac{a-t}{a^2-t^2} = \frac{a-t}{(a+t)(a-t)}$

   cancelling gives: $\frac{\cancel{a-t}}{(a+t)\cancel{(a-t)}} \Rightarrow \frac{1}{a+t}$

7a). Total number of cars:
50 + 80 + 160 + 20 + 60 + 100 + 120 + 10
= 600 cars *(also given this in the question)*

Less than 3 years old is the top row:
50 + 80 + 160 + 20 = 310 cars

P(less than 3 years old) = $\frac{310}{600} = \frac{31}{60}$

7b). From sample table :

greater than 2000 cc and 3 or more years old

= 10 cars.

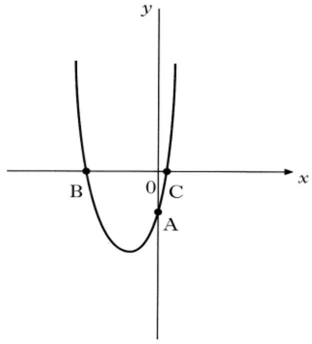
Probability of this is $\frac{10}{600} \Rightarrow \frac{1}{60}$

So out of a sample of 4200 cars

We would expect: $\frac{1}{60} \times 4200$ = **70 cars**

to be > 2000 cc and 3 or more years old

8.



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

8a). Coordinates of A are (0, –3)
From equation, when x = 0, y = –3

8b). Solve the equation $4x^2 + 4x - 3 = 0$
Factorise
$(2x-1)(2x+3) = 0$
So:
$2x - 1 = 0 \Rightarrow 2x = 1 \Rightarrow x = \frac{1}{2}$
and
$2x + 3 = 0 \Rightarrow 2x = -3 \Rightarrow x = -\frac{3}{2}$
Looking at the graph, clearly,

B is $\left(-\frac{3}{2}, 0\right)$ and C is $\left(\frac{1}{2}, 0\right)$

8c). Since a parabola is symmetrical,
the minimum value is at the bottom of the curve.

This will have its *x*–coordinate half way between B and C.

x–coordinate of minimum point is $-\frac{1}{2}$

use equation to find *y*, i.e. the minimum value

$$y = 4\left(-\tfrac{1}{2}\right)^2 + 4\left(-\tfrac{1}{2}\right) - 3$$

$$y = 1 - 2 - 3 \Rightarrow -4$$

minimum value of : $y = 4x^2 + 4x - 3$ is –4

9a) Look at the pattern:
$7^3 + 1 = (7+1)(7^2 - 7 + 1)$

9b). Again looking at the pattern
$n^3 + 1 = (n+1)(n^2 - n + 1)$

9c). $8p^3 + 1 \Rightarrow 8p^3 + 8 - 7$
Take out common factor of 8 in 1st 2 terms.
$8(p^3 + 1) - 7$ and using result from (b)
$8(p+1)(p^2 - p + 1) - 7$

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10. $\frac{\sqrt{3}}{\sqrt{24}}$ use rules of surds to combine

i.e. $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$ So $\frac{\sqrt{3}}{\sqrt{24}} \Rightarrow \sqrt{\frac{3}{24}}$

Simplify:

$\sqrt{\frac{3}{24}} \Rightarrow \sqrt{\frac{1}{8}}$ Look for largest square in 8

$\sqrt{\frac{1}{8}} \Rightarrow \sqrt{\frac{1}{4 \times 2}}$ Use rules of surds again

i.e. $\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$ $\sqrt{\frac{1}{4\times 2}} \Rightarrow \frac{1}{\sqrt{4 \times 2}}$

Now use rule for product of surds:

i.e. $\sqrt{a \times b} = \sqrt{a} \times \sqrt{b}$ $\Rightarrow \frac{1}{2\sqrt{2}}$

To rationalise the denominator, multiply top and bottom by $\sqrt{2}$.

$\Rightarrow \frac{1}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{4}$ (since $\sqrt{a} \times \sqrt{a} = a$)

11.a) $I = \frac{20}{2^c}$ put $c = 3$

$I = \frac{20}{2^3} \Rightarrow I = \frac{20}{8} \Rightarrow I = \frac{5}{2}$

11b). $I = \frac{20}{2^c}$ put $I = 10$

$10 = \frac{20}{2^c} \Rightarrow 10 \times 2^c = 20$

divide both sides by 10

$\Rightarrow 2^c = 2$ so, $c = 1$

11c). Maximum possible intensity is when the denominator is as small as possible.
This will be when $c = 0$

$I = \frac{20}{2^0} \Rightarrow I = \frac{20}{1} \Rightarrow I = 20$

because $2^0 = 1$

END OF QUESTION PAPER (*Rev. March 2007)*

CREDIT 2001 – Paper II

1. 10000×60 per hour

$10000 \times 60 \times 24$ per day

(2001 is not a leap year, so only 365 days)

$10000 \times 60 \times 24 \times 365$ per year

= 5 256 000 000 chocpops

Put in standard form: $= 5.256 \times 10^9$ chocpops

2.

	x	$x - \bar{x}$	$(x - \bar{x})^2$
	84.2	-0.13	0.0169
	84.4	0.07	0.0049
	85.1	0.77	0.5929
	83.9	-0.43	0.1849
	81.0	-3.33	11.0889
	84.2	-0.13	0.0169
	85.6	1.27	1.6129
	85.2	0.87	0.7569
	84.9	0.57	0.3249
	84.8	0.47	0.2209
TOTAL	843.3		14.821

a) Mean = $\dfrac{\sum x}{n} = \dfrac{843.3}{10} = 84.33$

S.D. = $\sqrt{\dfrac{14.821}{9}} = \sqrt{1.6468} = 1.283.... = 1.3$

b) The rural prices are more expensive (mean = 88.8) with more variation in the prices (std. dev = 2.4)

Note: this is where the alternative formula would be easier.

	x	x^2
	84.2	7089.64
	84.4	7123.36
	85.1	7242.01
	83.9	7039.21
	81.0	6561
	84.2	7089.64
	85.6	7327.36
	85.2	7259.04
	84.9	7208.01
	84.8	7191.04
TOTAL	843.3	71130.31

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

$$s = \sqrt{\frac{71130.31 - (843.3)^2 / 10}{10-1}}$$

$$s = \sqrt{\frac{71130.31 - 71115.489}{9}}$$

$$s = \sqrt{\frac{14.821}{9}}$$

then as above

3. The period of time 1999 – 2002 is 3 years

Value of house in 2002

$90,000 \times 1.05^3 = £\ 104,186.25$

Value of contents in 2002

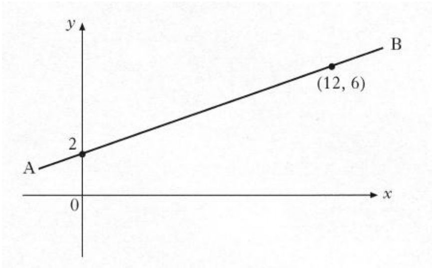
$60,000 \times 0.92^3 = £\ 46,721.28$

Total value House & Contents:

= £104,186.25 + £46,721.28

= £150,907.53

4. a)



gradient = $m = \dfrac{rise}{run} = \dfrac{6-2}{12-0} = \dfrac{4}{12} = \dfrac{1}{3}$

y-intercept $= c = 2$

Using: $y = mx + c$

Equation is: $y = \dfrac{1}{3}x + 2$

multiply throughout by 3

$3y = x + 6$ *now rearrange to required form*

$3y - x = 6$

b) To find coordinates where pipes cross. solve the equations simultaneously.

$3y - x = 6$ (1)

$4y + 5x = 46$ (2)

Multiply (1) by 5

$15y - 5x = 30$

$4y + 5x = 46$

Add equations

$19y = 76 \rightarrow y = 4$

Substitute into equation (1)

$3(4) - x = 6 \rightarrow 12 - x = 6$

Hence $x = 6$

Coordinates are: $(6, 4)$

Credit 2001 – Paper 2 *(continued)*

5. First find the volume of the can:

Volume of can (cylinder) = $\pi r^2 h$
diameter = 6.5 cm, so radius = 3.75 cm

$$Vol = \pi \times 3.75^2 \times 15 = 662.679... \text{ cm}^3$$

New can has same volume, but with height, 12 cm.
This time we want the diameter. So let the radius be *r*.

$$662.7 = \pi \times r^2 \times 12$$

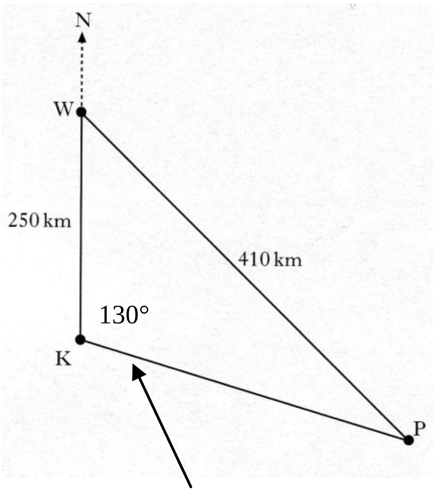
rearrange: $\dfrac{662.7}{\pi \times 12} = r^2$

hence $r^2 = \dfrac{662.7}{\pi \times 12} = 17.578...$

So radius, $r = \sqrt{17.578...} = 4.192....$

Hence diameter = 8.385 ... = **8.4 cm**

6.



Possum is on bearing of 130° from Kangaroo
Hence: ∠WKP = 130°

We want the bearing of Possum from Wallaby
i.e. the angle from North – W – P

If we can find ∠KWP , then we can take this from 180°

Using the sine rule, we can find ∠KPW, then this will let us find ∠KWP

Using the sine rule (with the angle form):

$$\frac{\sin \text{P}}{p} = \frac{\sin \text{K}}{k} \rightarrow \frac{\sin \text{P}}{250} = \frac{\sin 130^\circ}{410}$$

rearrange: $\rightarrow \sin \text{P} = \dfrac{250 \times \sin 130^\circ}{410}$

so, $\sin \text{P} = 0.4671 \rightarrow \text{P} = \sin^{-1}(0.4671)$

So P = 27.846..... = 28°
In triangle KPW, 130° + 28° = 158°
and so ∠KWP = 180° - 158° = 22 °

And bearing of Possum from Wallaby is:

180° - 22° = 158°

Possum is on a **bearing of 158°** from **Wallaby**.

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7. Solve $\tan 40^\circ = 2\sin x^\circ + 1 \quad 0 \le x \le 360$

tan 40° is just a number, so replace it.

tan 40° = 0.839

Hence: $0.839 = 2\sin x^\circ + 1$

So, $0.839 - 1 = 2\sin x^\circ$

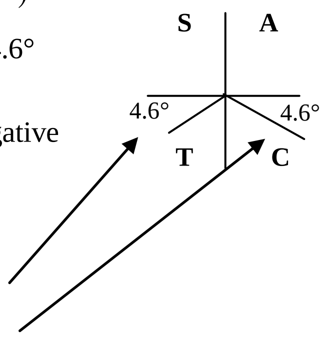
i.e. $2\sin x^\circ = 0.839 - 1$ simplify and divide by 2

$\sin x^\circ = -0.0805$

(Ignore the – sign, deal with this using ASTC)

acute $x = \sin^{-1}(0.0805)$

acute *x* = 4.617... = 4.6°



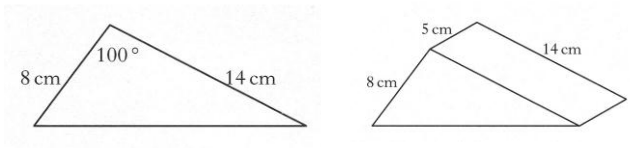
Using ASTC. sin is negative in quadrants 3 and 4.

Hence solutions are:

x = 180 + 4.6 = 184.6°
x = 360 – 4.6 = 355.4°

x = 184.6° and 355.4°

8.



Volume of prism = Area of cross section × length

Area of cross section: $= \frac{1}{2} ab \sin \text{C}$

$= \frac{1}{2} \times 8 \times 14 \times \sin 100^\circ = 55.149... = 55.1 \text{ cm}^2$

Volume of prism = $55.1 \times 5 = 275.5 \text{ cm}^3$

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9. Set up a proportionality

$$R \propto L \quad \text{and} \quad R \propto \frac{1}{d^2}$$

Combining these into an equation with a proportionality constant *k*.

$$R = k\frac{L}{d^2}$$

Now use information given in question.

Wire A: $R = k\frac{3}{2^2} \quad \rightarrow \quad R = \frac{3k}{4}$

Wire B: $R = k\frac{L}{3^2} \quad \rightarrow \quad R = \frac{kL}{9}$

The resistances are the same so:

$$\rightarrow \quad \frac{kL}{9} = \frac{3k}{4},$$

cross multiply to remove fractions:

$\rightarrow \quad 4kL = 27k$ cancel *k* from each side,

$$\rightarrow \quad L = \frac{27}{4} = 6.75 \text{ metres}$$

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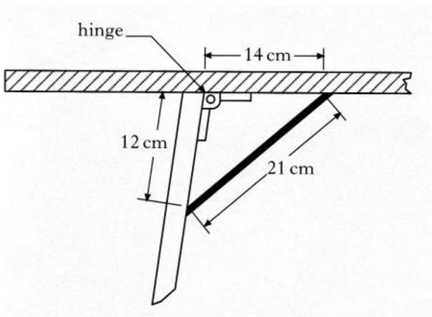
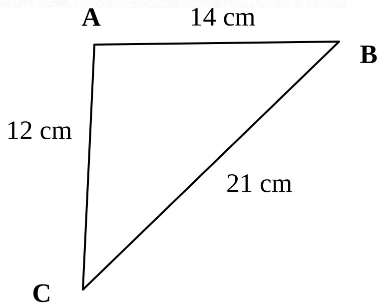
10. a)



Draw and label a triangle



This is **SSS**

Cosine Rule

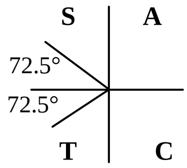
Using formula on formulae sheet:

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos A = \frac{12^2 + 14^2 - 21^2}{2 \times 12 \times 14} = -0.3005...$$

Remembering to use the calculator to find an acute angle, you take care of the negative sign.

acute A = $\cos^{-1}(0.3005) = 72.51...$



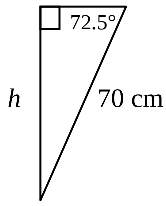
The cosine is negative in 2nd and 3rd quadrants.

We want the obtuse angle.

i.e. (2nd quadrant) 180 – 72.5 = 107.5°

Obtuse angle table top makes with leg = **107.5°**

b) We need another sketch.
The acute angle between leg and table top is 72.5°



This time use SOH-CAH-TOA
Use sine.

$$\sin 72.5 = \frac{h}{70} \rightarrow h = 70\sin 72.5 = 66.76...$$

Height of table is 66.8 cm

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11 a) new length: $30 + x$ cm

b) new width: $20 + x$ cm

Hence Area = length × breadth
New Area = $(30+x)(20+x)$

Use FOIL: $A = 600 + 30x + 20x + x^2$

Tidy up: $A = x^2 + 50x + 600$

c) New area to be at least 40% more
Original area = $20 \times 30 = 600$ cm^2
New area min: $600 \times 1.4 = 840$ cm^2

Hence minimum dimensions require:
$840 = x^2 + 50x + 600$
Rearrange to normal form:
i.e. $x^2 + 50x - 240 = 0$

Use quadratic formula

with *a* = 1, *b* = 50, *c* = -240

$$x = \frac{-50 \pm \sqrt{(50)^2 - 4(1)(-240)}}{2(1)}$$

$$x = \frac{-50 \pm \sqrt{2500 + 960}}{2} = \frac{-50 \pm \sqrt{3460}}{2}$$

Hence: *x* = -54.41 cm, or *x* = 4.41 cm

Hence minimum value of *x* has to be **5 cm** *(to nearest cm)* [discard negative value]

END OF QUESTION PAPER (*Rev. March 2007*)