**CREDIT 2001 – Paper II**

1. $10000 \times 60$ 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 = $\frac{\sum x}{n} = \frac{843.3}{10} = 84.33$

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

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 |

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

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

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

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

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

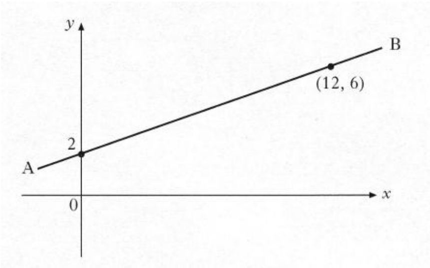
$60,000 \times 0.92^3$ = £ 46,721.28

Total value House & Contents:

= £104,186.25 + £46,721.28

**= £150,907.53**

4. a)




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

y-intercept $= c = 2$

Using: $y = mx + c$

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

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: $(6, 4)$

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

$Vol = \pi \times 3.75^2 \times 15 = 662.679...$ 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**

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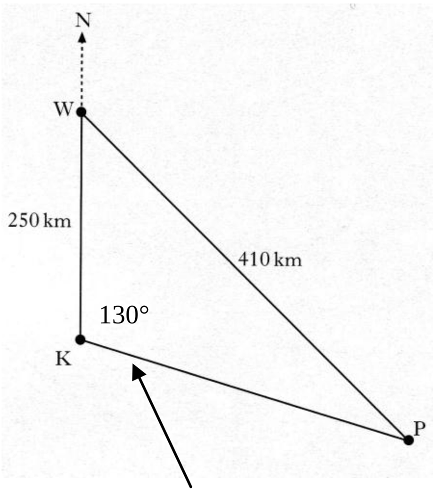
6.




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):

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

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

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 $\tan 40° = 2\sin x° + 1 \quad 0 \le x \le 360$

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

tan 40° = 0.839

Hence: $0.839 = 2\sin x° + 1$

So, $0.839 - 1 = 2\sin x°$

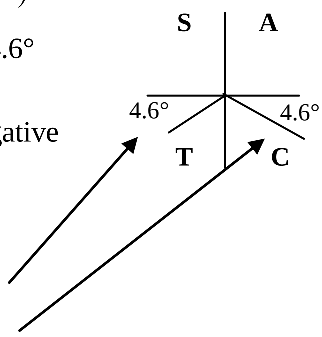
i.e. $2\sin x° = 0.839 - 1$ simplify and divide by 2

$\sin x° = -0.0805$

*(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°

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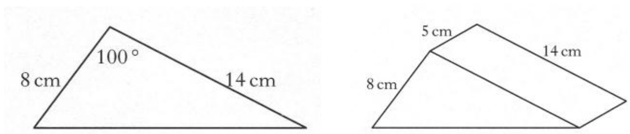
8.




Volume of prism = Area of cross section × length

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

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

Volume of prism = 55.1 × 5 = 275.5 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,

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

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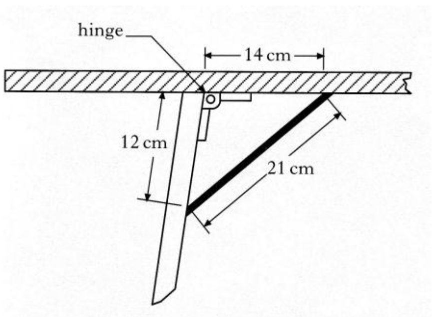
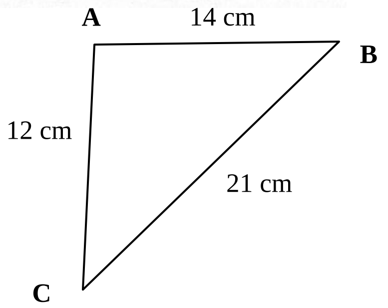
10. a)




Draw and label a triangle




This is **SSS**

**Cosine Rule**

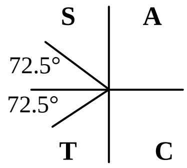
Using formula on formulae sheet:

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

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

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

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



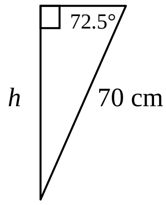

The cosine is negative in 2nd and 3rd quadrants.

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]

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