Intermediate 2 Units 1, 2, 3 Paper 2 2003

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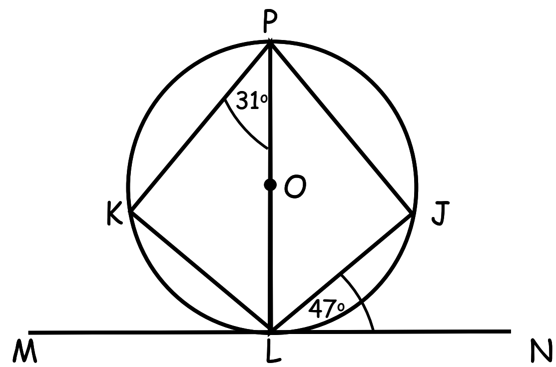
1. Given the diagram.
MN is a tangent that touches the circle centre O, at L.
Angle JLN = 47°.
Angle KPL = 31°.



To find angle KLJ we have:

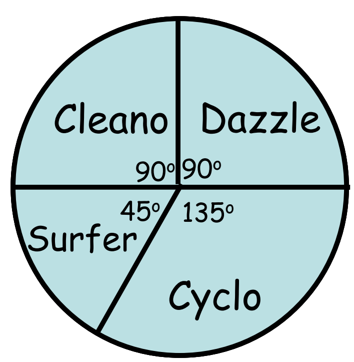
Angle PLN is right angled (tangent)
therefore PLJ is 90° – 47° = 43°

Triangle PKL is a right angled
Therefore angel PLK is 180° – 90° – 31° = 59°

Angle KLJ is 43° + 59° = 102°

2. Given the table of Frequencies for washing powder brands.
Constructing a Pie Chart we get:

Washing Powder	Frequency	Angle
Dazzle	250	$\frac{250}{1000}\times 360 = 90$
Cyclo	375	$\frac{375}{1000}\times 360 = 135$
Surfer	125	$\frac{125}{1000}\times 360 = 45$
Cleano	250	$\frac{250}{1000}\times 360 = 90$
Total :	1000	



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3. Given the information.
Flights prices are £30 and £50.
On one flight total of 130 sold.

(a) Equation for above would be x + y = 130.

The total sale for this flight was £6000.

(b) Equation for above would be 30x + 50y = 6000.

(c) Number of seats sold at £30 and £50 would be:

$x + y = 130$ eqn 1
$30x + 50y = 6000$ eqn 2

multiply eqn 1 by 30
$30x + 30y = 3900$ eqn 3
$30x + 50y = 6000$ eqn 2

sub tract eqn3 from eqn 2

$20y = 2100$ $y = 105$ seats at £50

sub in eqn 1 to find x

$x + 105 = 130$ $x = 25$ seats at £30

remember you can check values by substituting them into any of the other equations.

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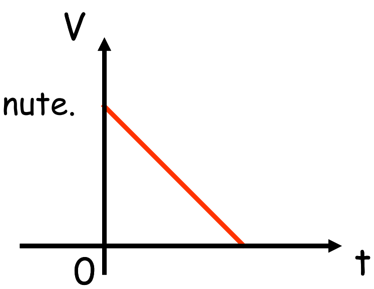
4. Given the diagram.
Bath contains 150 litres of water.
Water drains at a steady rate of 30 litres per minute.



The equation connection V and t is:

c = y intercept = 150

Gradient is -30 (water level is drop over time)

Line has equation $V = -30t + 150$

5. Given the temperatures (°C) in a greenhouse over the period of a week.

17 22 25 16 21 16 16

(a) The mean is:

$$\frac{17+22+25+16+21=16+16}{7} = 19^o C$$

The standard deviation is:

	x	x^2
	17	289
	22	484
	25	625
	16	256
	21	441
	16	256
	16	256
$\Sigma x =$	133	$\Sigma x^2 =$ 2607
$(\Sigma x)^2 =$	17689	

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

$$s = \sqrt{\frac{2607 - 17689/7}{7-1}}$$

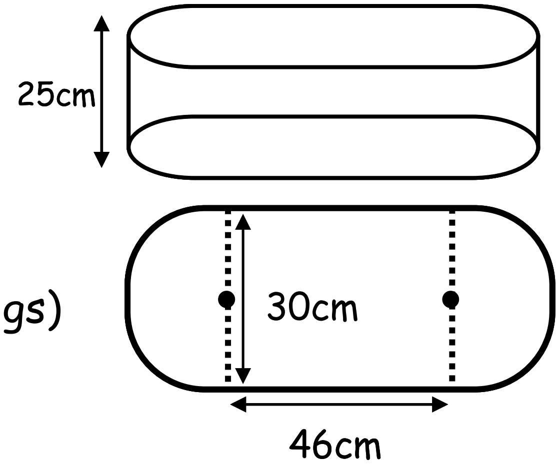
$$s = \sqrt{\frac{80}{6}}$$

$$s = 3.65$$

(b) Given best growth will occur when temperature is $20 \pm 5^o C$ and when the standard deviation is less than 5°C.

Since both conditions are met best growth is likely to occur.

6. Given the diagram and that the garden trough is in the shape of a prism. The height is 25cm. The cross-section is made up of a rectangle and two identical semi-circles.



(a) The volume is given by:

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

$$= (30 \times 46 + \pi \times 15^2) \times 25$$

$$= 52\ 000 cm^3$$ (two sig. figs)

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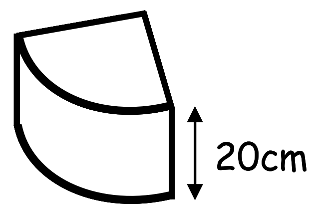
6. (b) Given the diagram and that the new design is a quarter of a circle with volume 30 000cm^2.

The radius of the cross-section will be:



$$V = \frac{1}{4}\left(\pi r^2\right) \times h$$

$$r^2 = \frac{4V}{\pi \times h}$$

$$r = \sqrt{\frac{4V}{\pi \times h}}$$ (Ignore negative value as it does not make sense in this context)

$$r = \sqrt{\frac{4 \times 30000}{\pi \times 20}}$$

$$r = 43.7cm$$

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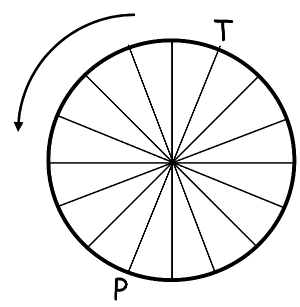
Q7. Change the subject of the formula to x we get:

$$y = ax^2 + c$$
$$ax^2 + c = y$$
$$ax^2 = y - c$$
$$x^2 = \frac{y-c}{a}$$
$$x = \pm\sqrt{\frac{y-c}{a}}$$

Q8. Given the diagram.
Chairs are equally spaced out.

Distance from T to P going anti clockwise can be calculated as follows:

$$C_{arc} = \frac{arc^o}{full\ circle^o} \times 2\pi r$$
$$C_{arc} = \frac{22.5^o}{360^o} \times 2 \times \pi \times 9$$
$$C_{arc} = 3.53cm$$



7 equal arcs therefore distance $= 7 \times 3.53 = 24.7m$

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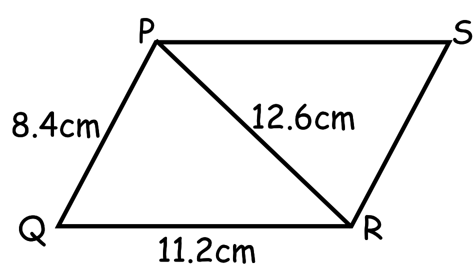
Q9. Solving the equation we get:

$$2x^2 + 4x - 9 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$x = \frac{-4 \pm \sqrt{16+72}}{4}$$
$$x = \frac{-4 \pm \sqrt{88}}{4}$$
$$x = \frac{-4 + \sqrt{88}}{4} \quad \text{and} \quad x = \frac{-4 - \sqrt{88}}{4}$$
$$x = 1.3 \quad \text{and} \quad x = -3.3$$

Q10. Given the diagram of the parallelogram.



(a) The size of angle PQR is:

$$\cos Q^o = \frac{r^2 + p^2 - q^2}{2rp}$$
$$\cos Q^o = \frac{8.4^2 + 11.2p^2 - 12.6^2}{2 \times 8.4 \times 11.2}$$

$$\cos Q^o = 0.198^o \qquad Q^o = 78.6^o$$

(b) The area of the parallelogram is made up of 2 identical triangle:

$$Area = 2 \times \frac{1}{2} rp \sin Q^o$$
$$Area = 8.4 \times 11.2 \times \sin 78.6^o = 92.2cm^2$$

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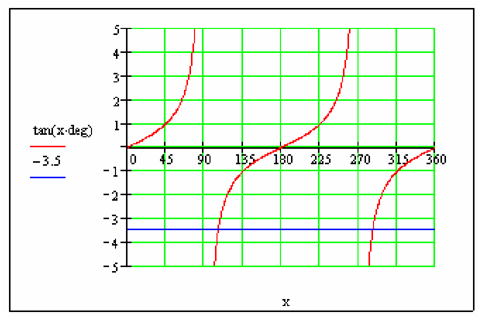
Q11. (a) Expressing $a^{\frac{2}{3}}(a^{\frac{2}{3}} - a^{-\frac{2}{3}})$ in its simplest form we get:

$$a^{\frac{2}{3}}(a^{\frac{2}{3}} - a^{-\frac{2}{3}}) = a^{\frac{2}{3}} \times a^{\frac{2}{3}} - a^{\frac{2}{3}} \times a^{-\frac{2}{3}} = a^{\frac{4}{3}} - a^0 = a^{\frac{4}{3}} - 1$$

(b) Expressing $\frac{a}{x} - \frac{b}{y}$ as a single fraction in its simplest form we get:

$$\frac{a}{x} - \frac{b}{y} = \frac{ay - bx}{xy}$$



12. (a) Solving the equation we get:

$2\tan x^o + 7 = 0 \qquad 0 \leq x^o \leq 360^o$

Remember there will be 2 solutions in the range $0 \leq x^o \leq 360^o$

$$\tan x^o = -\frac{7}{2}$$

$$x^o = \tan^{-1}\left(-\frac{7}{2}\right) = 105.9^0 \quad \text{and} \quad 360^o - 74.1^o = 285.9^o$$

(b) Proving that $\sin^3 x^o + \sin x^o \cos^2 x^o = \sin x^o$ we get:

Taking out $\sin x^o$ as common factor and knowing $(\sin^2 x^o + \cos^2 x^o) = 1$

$$\sin x^o(\sin^2 x^o + \cos^2 x^o) = \sin x^o$$