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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

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

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

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

$$(\Sigma x)^2 = 76176$$

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

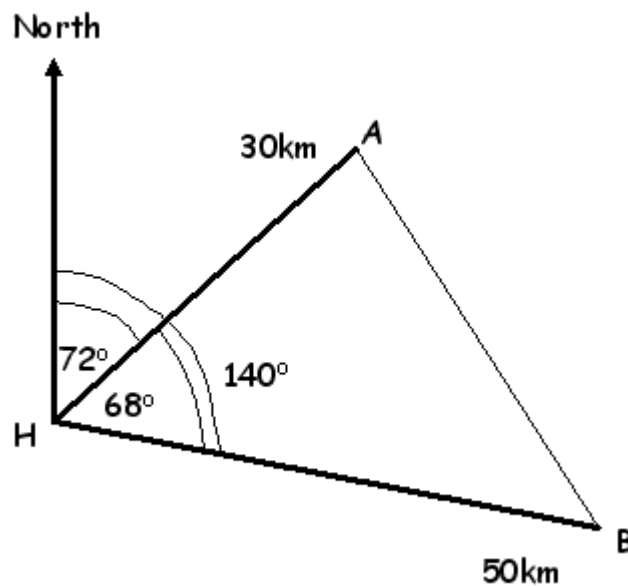
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- (c) One valid comparison between the sugar with standard deviation 2.6 and the milk is:-

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.

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

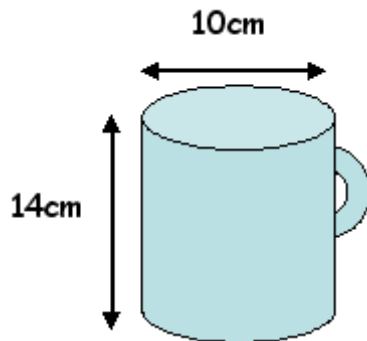
$$h = \sqrt{(30^2 + 50^2 - 2 \cdot 30 \cdot 50 \cdot \cos(68^\circ))}$$

$$h = 47.7\text{km}$$

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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

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

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

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

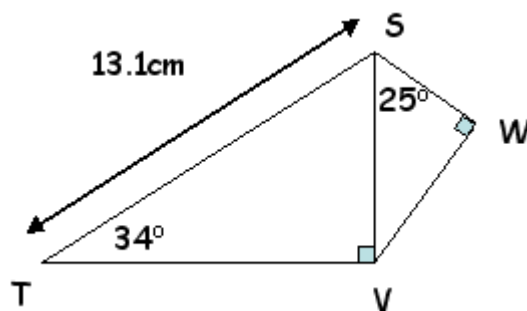
$$n = 8 \quad \text{or} \quad n = -5$$

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

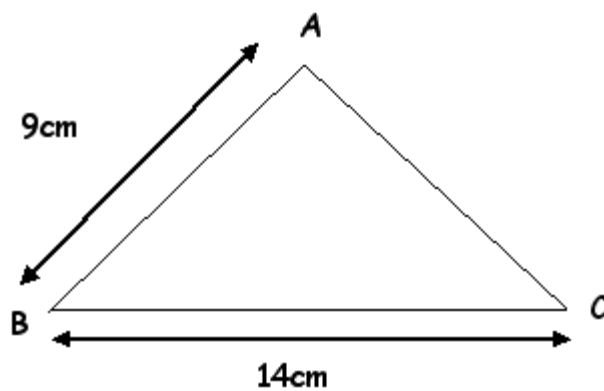
$$SV = 13.1 \cdot \sin(34^\circ) = 7.33\text{cm}$$

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

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7. From information given we have



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

To find angle ABC we have

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

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

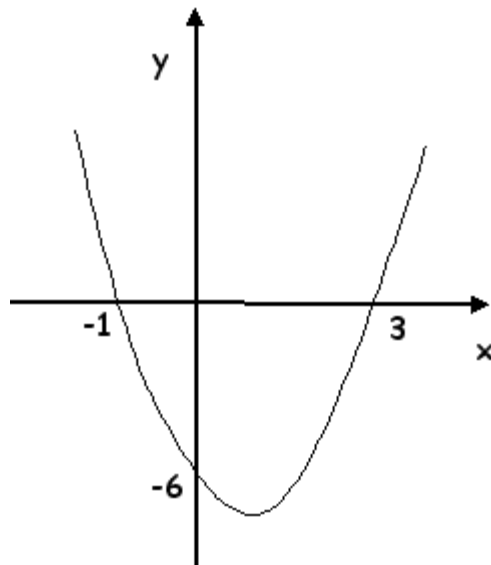
$$\sin(B) = \frac{38}{63}$$

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

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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 $x = 0$ $y = -6$

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

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

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

By symmetry the x co-ordinate is

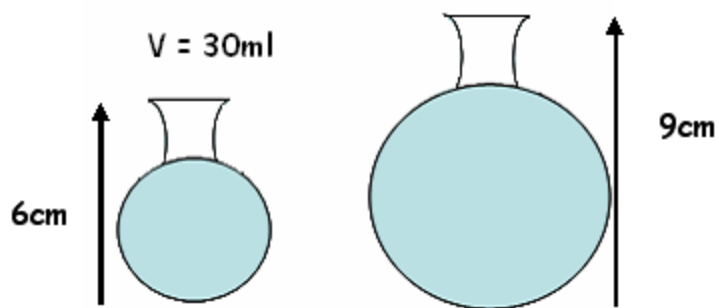
$$\frac{(-1 + 3)}{2} = 1$$

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



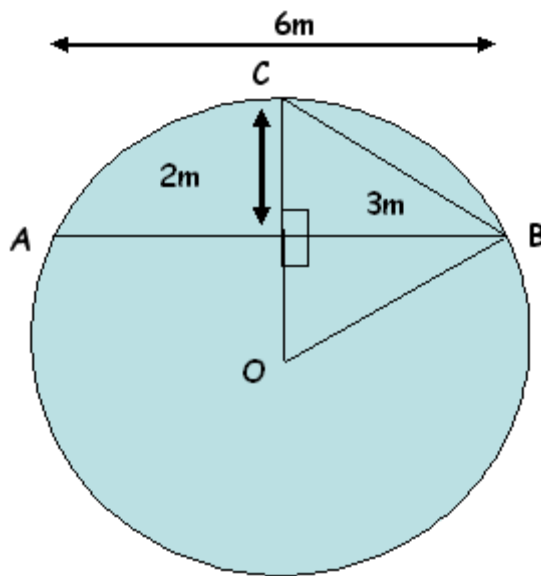
Since the bottles are mathematically similar the larger bottle has volume

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

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10. From the information given we have



To calculate BO we have by

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

$$\text{Angle } ABC = 180^\circ - 90^\circ - 56.3^\circ = 33.7^\circ$$

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

Hence

$$\text{Angle } OBC = 56.3^\circ \text{ and angle } OBA = 56.3^\circ - 33.7^\circ = 22.6^\circ$$

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

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

(a)
$$T = \frac{D}{S} = \frac{x}{75} \text{ hours}$$

- (b) Hence average speed for whole journey is

$$\begin{aligned} S &= \frac{D}{T} \\ &= \frac{2x}{\frac{x}{75} + \frac{x}{50}} \\ &= \frac{2x}{\frac{2x+3x}{150}} \\ &= \frac{300x}{5x} \\ &= 60 \text{ km/hr} \end{aligned}$$