

BHASVIC MαTHS

A1 DOUBLES ASSIGNMENT 3B

1

Draw labelled mathematical diagram(s) to model each of the following situations.

Note – Use capital letters for forces, e.g. **W** for weight, **R** for normal reaction, **T** for tension, **F** for friction. An unknown force of indeterminate cause is often called **P** or **X** .

- You'll need to use the fact that an object with mass m kg will have a weight of mg N, where g is the acceleration due to gravity.

- (a) A book of mass 400 g resting on a horizontal table
- (b) A fish of mass M kg dangling from a vertical fishing line
- (c) An ice hockey puck gliding across the ice at a constant velocity
- (d) A box of mass 75 g resting on a rough table which is sloping at an angle 30° to the horizontal
- (e) A dog, being dragged along by its lead (at an angle 45° to the horizontal), from rest
- (f) The head of a mop being pushed across the floor at a constant speed by its handle (which is at angle 30° to the horizontal)
- (g) A wet jumper hanging by a smooth hanger on a washing line.

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2

(a) Simplify $\frac{3-2\sqrt{5}}{\sqrt{5}-1}$ giving your answer in the form $p + q\sqrt{5}$

(b) Write these in the form 2^k :

(i) $8\sqrt{2}$

(ii) $\left(\frac{1}{4}\right)^{\frac{1}{2}}$

(iii) $(-8)^{-3}$

(iv) $\left(-\frac{1}{8}\right)^{\frac{-1}{3}}$

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3

On my way to college I pass through two sets of traffic lights that operate independently (this means that having to wait at the first set doesn't make it more or less likely that I'll have to wait at the second). The probabilities that I have to wait at these two sets of traffic lights are 0.3 and 0.4 respectively. What is the probability that I am delayed by at least one of the sets of traffic lights?

(Hint: draw a tree diagram!)

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Estimate the standard deviation and 30% – 70% interpercentile range of each distribution:

(a)

Score	100-106	107-113	114-120	121-127	128-134
Frequency	6	11	22	9	2

(b)

<i>x</i>	2-4	4-7	7-10	10-15
<i>f</i>	2	10	22	6

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A swimmer and a fish set off from the same place at the same time. The swimmer swims in a straight line with constant velocity 1 ms^{-1} . The fish accelerates uniformly from rest to $U \text{ ms}^{-1}$ in 2 seconds, then maintains this speed. It moves in a straight line throughout its motion, and overtakes the swimmer 5 seconds after they set off.

(a) Draw a velocity time graph to show the motion of the swimmer and the fish

(b) Use your graph to find the value of U .

TAP FOR ANSWERS

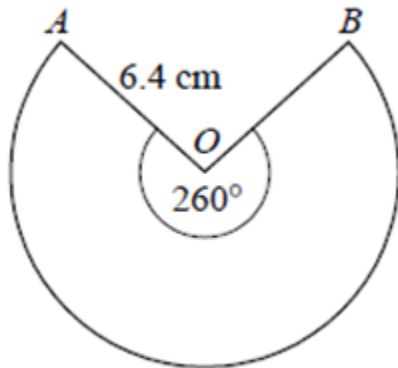
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The diagram shows the major sector OAB of a circle, centre O , radius 6.4 cm
The reflex angle subtended by the major arc AB at O is 260° .

- (a) Express 260° in radians, correct to 3 decimal places.
- (b) Find the perimeter of the major sector OAB .
- (c) Find the area of the major sector OAB .



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An adult evening class has 14 students. The ages of these students have a mean of 31.2 years and a standard deviation of 7.4 years.

A new student who is exactly 42 years old joins the class. Calculate the mean and standard deviation of the 15 students now in the group.

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(i) Given the mean \bar{x} and the variance, σ_x^2 of the distribution X , find the mean \bar{y} and the variance, σ_y^2 of the coded data Y :

(a) $\bar{x} = 231, \sigma_x^2 = 19.5, Y = \frac{1}{3}X - 1$ (b) $\bar{x} = 9.08, \sigma_x^2 = 1.5, Y = 5 + \frac{1}{2}X$

(c) $\bar{x} = -7.13, \sigma_x^2 = 1.85, Y = 7 - X$ (d) $\bar{x} = 36, \sigma_x^2 = 12, Y = X - 10$

(ii) Given the mean \bar{y} and the variance, σ_y^2 of the coded data Y , find the mean \bar{x} and the variance, σ_x^2 of the un-coded data X :

(a) $\bar{y} = 13.7, \sigma_y^2 = 3.12, Y = \frac{1}{6}X - 3$

(b) $\bar{y} = 2.01, \sigma_y^2 = 0.561, Y = 3 + \frac{3}{5}X$

(c) $\bar{y} = 7630, \sigma_y^2 = 185, Y = 7600 - X$

(d) $\bar{y} = 58.3, \sigma_y^2 = 10.1, Y = X + 2$

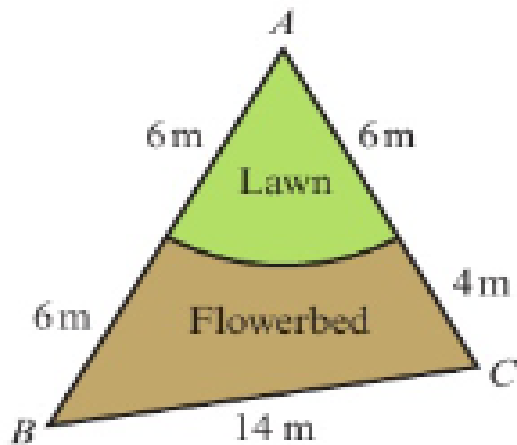
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The diagram shows a triangular plot of land. The sides AB , BC and CA have lengths 12 m, 14 m and 10 m respectively. The lawn is a sector of a circle, centre A and radius 6 m.



- (a) Show that $\angle BAC = 1.37$ radians, correct to 3 significant figures.
- (b) Calculate the area of the flowerbed.

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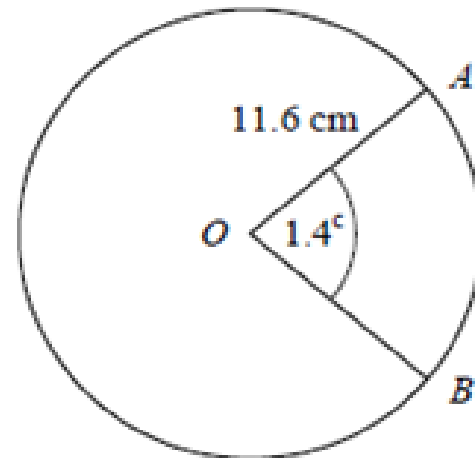
A1 DOUBLES ASSIGNMENT 3B

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The diagram shows a circle of radius 11.6 cm, centre O. The arc of the circle AB subtends an angle of 1.4 radians at O.

Find, to 3 significant figures,

- the perimeter of the minor sector OAB,
- the perimeter of the major sector OAB,
- the area of the minor sector OAB,
- the area of the major sector OAB.



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The letters of the words STATISTICS are written on 10 separate pieces of card which are shuffled.

The top 3 cards are turned over. Find the probability that:

- (a) the 3 cards are all vowels
- (b) 2 of the 3 cards show the letter T
- (c) the 3 cards contain at least 1 vowel
- (d) the first 2 cards turned over are both T

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Solve these equations by writing them in the form (number)^{thing 1} = (same number)^{thing 2}

(a) $4(2^x)^2 = 8^x\sqrt{2}$

(b) $\frac{5^{2x+1}}{\sqrt{5}} = 25(5^x)$

(c) $5(5^{x+3})^2 = \frac{1}{125}$

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13

A ball A falls vertically from rest from the top of a tower 63m high. At the same time as A begins to fall, another ball B is projected vertically upwards from the bottom of the tower with speed 21m/s.

The balls collide.

Find the distance of the point where the balls collide from the bottom of the tower.

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14

A car travels with uniform acceleration between three lamp posts, equally spaced at 18 m apart. It passes the second post 2 seconds after passing the first post and passes the third post 1 second later.

- (a) Find the car's acceleration
- (b) Find the car's velocity when it passes the first post

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The table shows the mean daily temperatures at each of the eight weather stations for August 2015.

	Camborne	Heathrow	Hurn	Leeming	Leuchars	Beijing	Jacksonville	Perth
Mean daily mean temp (°C)	15.4	18.1	16.2	15.6	14.7	26.6	26.4	13.6

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- Give a geographical reason why the temperature in August might be lower in Perth than in Jacksonville.
- Comment on whether this data supports the conclusion that coastal locations experience lower average temperatures than inland locations

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1 - Answers

Checked by your teacher.

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2 - Answers

- a) Type the question into your calculator, then minus your answer from this. If you are correct then this will equal zero.
- b) Sub your value for k into the expression 2^k & check it equates with the original expression.

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3 - Answers

0.58

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4 - Answers

(a) $sd = 7,$ $IPR = 7$

(b) $sd = 2.45$ (3sf), $IPR = 2.18$ (3sf)

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5 - Answers

(b) $U = 1.25$

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6 - Answers

- a) 4.538
- b) 41.8 cm
- c) 92.9 cm²

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7 - Answers

$$\bar{x} = 31.9$$

$$\sigma = 7.6$$

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8 - Answers

(i) (a) 76, 2.17 (b) 9.54, 0.375 (c) 14.1, 1.85 (d) 26, 12

(ii)(a) 100.2, 112.32 (b) -1.65 , 1.56 (c) 30, 185 (d) 56.3, 10.1

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9 - Answers

(a) $A = \cos^{-1}(0.2) = 1.369438406 \dots = 1.37$ (3 s.f.)

(b) 34.1 m^2

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10 - Answers

- a) 39.4cm
- b) 79.8 cm
- c) 94.2 cm²
- d) 329cm²

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11 - Answers

(a) $\frac{1}{120}$

(b) $\frac{7}{40}$

(c) $\frac{17}{24}$

(d) $\frac{1}{15}$

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12 - Answers

(a) $x = \frac{3}{2}$ (b) $x = \frac{3}{2}$

(c) $x = -5$

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13 - Answers

18.9m

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14 - Answers

(a) 6 ms^{-2} (b) 3 ms^{-1}

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15 - Answers

- (a) Perth is in the southern hemisphere so August is a winter month.
- (b) The lowest temperatures in the UK are at coastal locations (Camborne and Leuchars). The highest temperature is at an inland location (Beijing). There is some evidence to support this conclusion.

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