

# Maths Exercises - Worksheet 3

## Pure Maths

1. How do we know that  $x^2 + 2x + 1$  is always positive irrespective of the value of  $x$ ? .....

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2. Simplify the following: a)  $x^2 \times x^5$ , b)  $4y^9 \div 2y^4$ , c)  $(2z^3)^4$  .....

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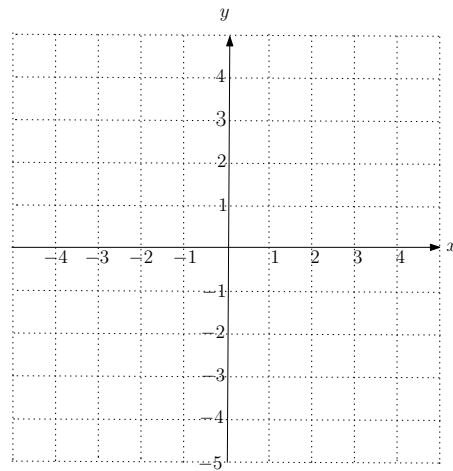
3. Line 1 has equation  $y = 2x + 1$ . Line 2 is perpendicular to line 1 and shares the same  $y$ -intercept. Sketch line 2 and find its equation.

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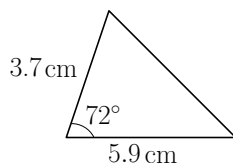
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4. Expand and simplify  $(x + y)^3$ . .....

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5. Given the triangle with sides 3.7cm and 5.9cm and an angle of  $72^\circ$  as follows, find the area of the triangle to 1 decimal place.



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6. Find the value of  $x$  in the following: a)  $4^x = 64$ , b)  $5^x = 1$ , c)  $3^x = \frac{1}{3}$ , d)  $2^x = \frac{1}{4}$ .

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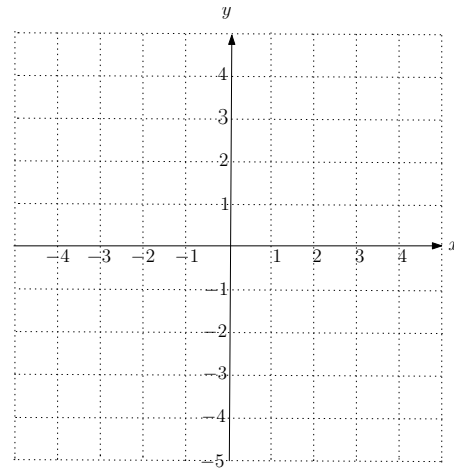
7. Differentiate the following with respect to  $x$ : a)  $x^3$ , b)  $3x^{-2}$ , c)  $4x^7 - 8x^{-3} + 5$ .

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8. Sketch the lines  $y = x + 1$  and  $x = 4$ . Find the area contained within these lines and the  $x$ -axis. ....

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9. The length of vector  $\mathbf{a}$  is denoted  $|\mathbf{a}|$ . Calculate  $|\mathbf{a}|$  if  $\mathbf{a} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}$ .

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### Statistics

1. Find the mean of the following numbers, call it  $\bar{x}$ :

$$2, 8, 6, 4, 5, 9, 3, 5, 7, 3$$

Subtract  $\bar{x}$  from each data element and square each result. Add up all of these results and divide by how many there are, call the result  $\sigma^2$  (variance). Calculate  $\sigma$  (standard deviation).

2.  $A$  and  $B$  are events such that  $P(A' \cap B) = \frac{1}{2}$ ,  $P(A \cap B') = \frac{1}{3}$  and  $P(A' \cap B') = \frac{1}{8}$ . Display this information in a Venn diagram and find  $P(A \cap B)$ .

### Mechanics

1. Put a circle around each quantity that represents a vector:

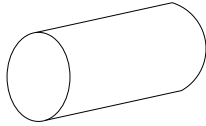
**speed      velocity      acceleration      distance      force**

2. Put a circle around each quantity that represents a force.

**weight      acceleration      mass      tension      friction**

## Exam Practice

A cylinder's length is twice its diameter and has a volume of  $\frac{27}{2}\pi$  units<sup>3</sup>.



- Find the length of the cylinder.
- Find the surface area of this cylinder, in terms of  $\pi$ .

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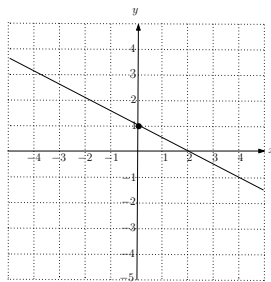
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## Solutions

### Pure Maths

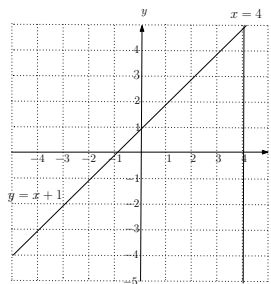
- $x^2 + 2x + 1$  is always positive because it can be written as  $(x + 1)^2$  - a square number is always positive.
- a)  $x^7$ , b)  $2y^5$ , c)  $16z^{12}$ .
- $y = -\frac{1}{2}x + 1$ .



- $x^3 + 3x^2y + 3xy^2 + y^3$ .
- 10.4 cm<sup>2</sup>.

### Statistics

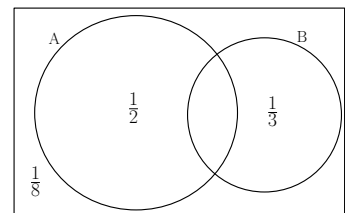
- a)  $x = 3$ , b)  $x = 0$ , c)  $x = -1$ , d)  $x = -2$
- a)  $3x^2$ , b)  $-6x^{-3}$ , c)  $28x^6 + 24x^{-4}$ .
- 12.5 units<sup>2</sup>



9.  $|a| = \sqrt{(3)^2 + (-4)^2} = 5$ .

### Statistics

- $\bar{x} = 5.2$ ,  $\sigma^2 = 4.76$ ,  $\sigma = 2.18$ .
- $P(A \cup B) = \frac{1}{24}$



### Mechanics

- velocity, acceleration, force
- weight, tension, friction

### Exam Practice

- $x = 3$
- $\frac{45}{2}\pi$ .

## Notes

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