

## Show all working – Calculator allowed.

1. Simplify, giving your answer in surd form:

a) $\sqrt{12}$	(b) $\sqrt{27}$	(c) $\sqrt{32}$	(d) $\sqrt{75}$	(e) $\sqrt{20}$
f) $\sqrt{45}$	(g) $\sqrt{44}$	(h) $\sqrt{300}$	(i) $\sqrt{125}$	(j) √72

**2.** Simplify the following:

a)  $y^3 \times y^4$  (b)  $4m^3 \times 3m^2$  (c)  $g^6 \div g^2$  (d)  $(h^3)^2$  (e)  $\frac{x^4}{x}$ f)  $\frac{12x^5}{4x^2}$  (g)  $\frac{h^7 \times h^{-2}}{h^3}$  (h)  $y^9 \times (y^5)^{-2}$  (i)  $4m^3 \times 2m^{-1/2}$  (j)  $(2m^3)^3$ 

- **3.** Give your answers to the following questions in Scientific Notation.
  - a) There are  $3.1 \times 10^7$  seconds in a solar year. How many seconds are there in 5 solar years?
  - **b**) The Lotto jackpot of  $\pounds 8.4 \times 10^6$  was shared amongst 3 winners. How much did each winner receive?
  - c) A bee weighs approximately  $1.98 \times 10^{-4}$  kg. A newly hatched baby eagle is 93 times heavier. Calcualte the weight of the baby eagle.
- 4. Expand and simplify where appropriate:
  - a) 5(x+4)(b) 4(2x-3y)(c) a(3a+b)(d) m(5m-6)e) y(2y-6)(f) y(2y+x)(g) (x+3)(x+5)(h) (m+4)(m-3)
  - i) (h-3)(h-5) (j) (x-4)(x+5) (k)  $(x+6)^2$  (l)  $(x-5)^2$

5. a) Find the area of this rectangle in terms of x:





Show that the area of this composite shape can be given by  $2x^2 + 16x + 22$ 

c) The large rectangle opposite has a small rectangle (4m by 3m) cut out of it. Show that the shaded area of the shape can be expressed as  $x^2 + 11x + 12$ 



**6.** Factorise the following:

<b>a</b> ) 2x + 6	<b>(b)</b> $14y - 7$	(c) $4a + 6b$	(d) $10x - 25y$
<b>e</b> ) $y^2 + 7y$	(f) $a^2 - 3a$	(g) $3d^2 + 5d$	<b>(h)</b> $6m^2 - 3m$
<b>i</b> ) $x^2 - 16$	(j) $y^2 - 25$	<b>(k)</b> $a^2 - 100$	(1) $p^2 - 1$
<b>m</b> ) $x^2 + 6x + 5$	( <b>n</b> ) $y^2 + 5y + 6$	( <b>o</b> ) $h^2 + 8h + 15$	( <b>p</b> ) $x^2 + 8x + 12$

- 7. Express the following in the form  $(x + p)^2 + q$  [Complete the Square]
  - a)  $x^2 + 6x + 4$ (b)  $x^2 + 8x + 1$ (c)  $x^2 + 8x - 10$ (d)  $x^2 + 4x + 1$ (e)  $x^2 + 10x - 8$ (f)  $x^2 + 2x - 3$
- 8. Write each algebraic fraction in its simplest form:
  - a)  $\frac{(x+4)(x+6)}{(x+6)}$  (b)  $\frac{x-4}{(x-4)(x-5)}$  (c)  $\frac{(x-6)^2}{(x-6)(x+4)}$
  - d)  $\frac{(x+6)(x-7)}{(x-7)^2}$  (e)  $\frac{(3x+5)^2}{(3x+5)(2x+1)}$  (f)  $\frac{(2x+1)(4x-7)}{(4x-7)^2}$

9. Write each of these as a single fraction:

a) 
$$\frac{3}{5} + \frac{5}{8}$$
 (b)  $\frac{6}{x} + \frac{3}{y}$  (c)  $\frac{3}{b} + \frac{4}{a}$  (d)  $\frac{8}{x} - \frac{3}{y}$   
e)  $\frac{2}{m} - \frac{3}{n}$  (f)  $\frac{3}{4} \times \frac{5}{7}$  (g)  $\frac{6}{7} \times \frac{2}{3}$  (h)  $\frac{4}{x} \times \frac{3}{y}$   
i)  $\frac{4}{a} \times \frac{b}{c}$  (j)  $\frac{5}{6} \div \frac{2}{3}$  (k)  $\frac{c}{d} \div \frac{4}{b}$  (l)  $\frac{x}{5} \div \frac{y}{z}$ 

**10.** For the following points A(6, 3), B(8, 4), C(4, 6) & D(6, 10):

- a) Find the gradient of AB (b) Find the gradient of CD
- c) Which line is steeper? Explain your answer.
- **11.** For the following points E(-2, 1), F(1, 4), G(-4, 2) & H(6, 4):
  - a) Find the gradient of EF (b) Find the gradient of GH
  - c) Which line is steeper? Explain your answer.

## **12.** Find the gradient of the line joining the points:

- **a**) K(4, -3) & L(-1, 9) (**b**) M(-4, -3) & N(-1, -7)
- 13. Calculate the volume of the following, giving your answer correct to 2 Sig. Figs.



14. A tank in the shape of a cuboid is full of water.The water is poured out into a cylinder shaped tub.The dimensions of both containers are shown here:

Will the cylinder hold <u>all</u> the water from the tank or will it overflow. Explain your answer fully.

15. Some plastic spherical ball bearings are melted down And remoulded to make a cone. The ball bearings have A diameter of 1.6cm. The cone must have a radius of 3.4cm and a height of 4.2cm. How many ball bearings need to be melted down to make the cone? Explain your answer fully.



**16.** Calculate the Arc Length of the Minor arc in the following:



- **17.** Calculate the Minor Sector Area of the shapes above.
- 18. The diagram shows a sector of a circle, centre C.The radius of the circle is 7.3cm and angle PCR is 54°Calculate the area of the sector PCR.





A sector of a circle, centre O, is shown. The radius of the circle is 2.3m & angle AOB is 65° Find the length of the arc AB 20. A sweet shop sells sweets in a cone shaped. cardboard container The cone is formed by cutting a sector from a circular piece of cardboard as shown. The radius of the circle is 30cm and angle AOB is 100°



- a) Calculate the area of the card used to make the cone.
- **b**) Calculate the lengtyh of arc AB
- c) To strengthen the cone the shop wants the top rim to be edged in a red plastic trim.What is the maximum number of cones which can be edged using 25 metres of plastic trim?
- 21. Party hats for a kids birthday party are made from cardboard sectors as shown below.The radius of OB is 8cm and angle AOB is 135°. Yellow ribbon is used to edge the base of the hats.What is the maximum number of hats which can be decorated with 125 metres of ribbon?



