



1. (a) Find the sum of all the integers between 1 and 1000 which are divisible by 7. (3)

(b) Hence, or otherwise, evaluate  $\sum_{r=1}^{142} (7r + 2)$ . (3)

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2. Solve the simultaneous equations

$$\begin{aligned}x - 3y + 1 &= 0, \\x^2 - 3xy + y^2 &= 11.\end{aligned}$$

(7)

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3. The first three terms of an arithmetic series are  $p$ ,  $5p - 8$ , and  $3p + 8$  respectively.

(a) Show that  $p = 4$ . (2)

(b) Find the value of the 40th term of this series. (3)

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4.  $f(x) = x^2 - kx + 9$ , where  $k$  is a constant.

(a) Find the set of values of  $k$  for which the equation  $f(x) = 0$  has no real solutions. (4)

Given that  $k = 4$ ,

(b) express  $f(x)$  in the form  $(x - p)^2 + q$ , where  $p$  and  $q$  are constants to be found, (3)

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5.  $\frac{dy}{dx} = 5 + \frac{1}{x^2}$ .

(a) Use integration to find  $y$  in terms of  $x$ . (3)

(b) Given that  $y = 7$  when  $x = 1$ , find the value of  $y$  at  $x = 2$ . (4)

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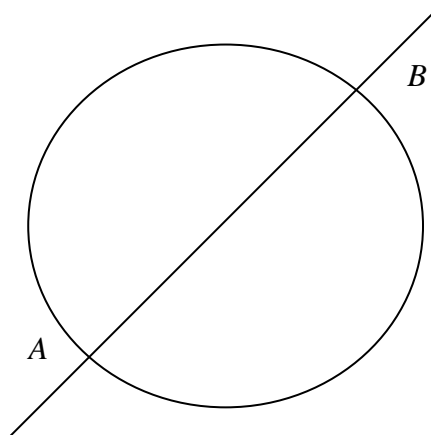
6. A container made from thin metal is in the shape of a right circular cylinder with height  $h$  cm and base radius  $r$  cm. The container has no lid. When full of water, the container holds  $500 \text{ cm}^3$  of water.

Show that the exterior surface area,  $A \text{ cm}^2$ , of the container is given by

$$A = \pi r^2 + \frac{1000}{r}. \quad (4)$$


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7. **Figure 1**



The points  $A(-3, -2)$  and  $B(8, 4)$  are at the ends of a diameter of the circle shown in Fig. 1.

- (a) Find the coordinates of the centre of the circle. (2)
- (b) Find an equation of the diameter  $AB$ , giving your answer in the form  $ax + by + c = 0$ , where  $a$ ,  $b$  and  $c$  are integers. (4)
- (c) Find an equation of tangent to the circle at  $B$ . (3)

The line  $l$  passes through  $A$  and the origin.

- (d) Find the coordinates of the point at which  $l$  intersects the tangent to the circle at  $B$ , giving your answer as exact fractions. (4)

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**END**