AQA, Edexcel, OCR, MEI

A Level

A Level Mathematics

C1 Coordinate Geometry (Curves) (Answers)

Name:

MME
Mathsmadeeasy.co.uk

Total Marks: /55

1. Sketch the following quadratic functions, clearly indicating the points of any intersections with the axes and the locations of any minimum/maximum points:

(a) [2]

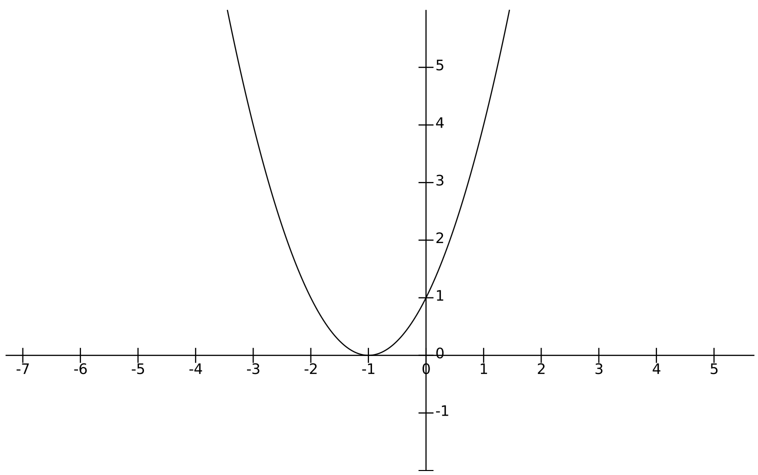


Figure 1: $y = x^2 + 2x + 1$

(b) [2]

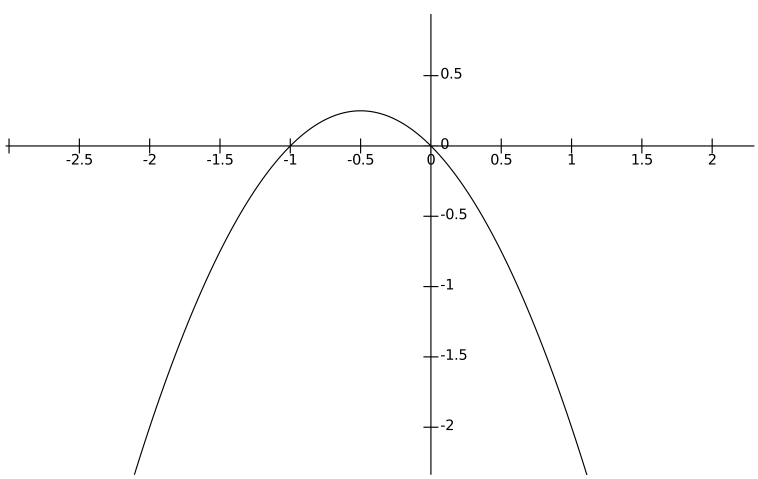


Figure 2: $y = -(x^2 + x)$

(c) [2]

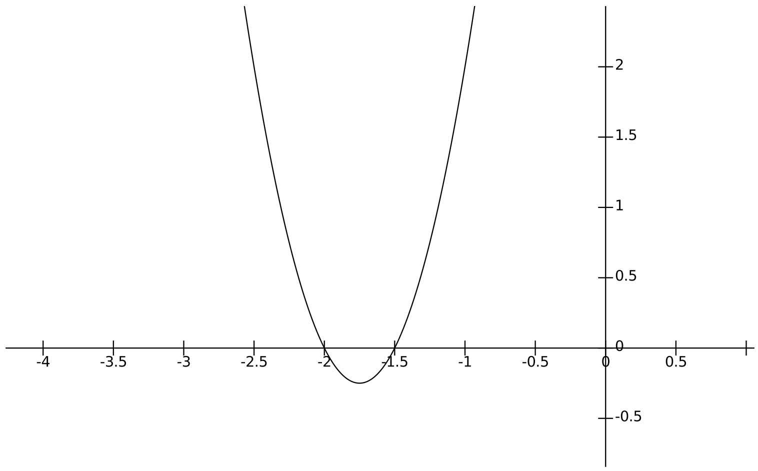


Figure 3: $4x^2 + 14x + 12$

2. Find the point(s) of intersection between the following curves:

   (a) $(-1, -1)$. [2]

   (b) $(-5, 15)$ and $(2, -6)$. [2]

   (c) $(2, -3)$ and $(6, 13)$. [2]

   (d) $(1, 1)$. [3]

   (e) $(-1, 1)$ and $(3, -7)$. [3]

   (f) $\left(\sqrt{\frac{5}{2}} - 1, 29 - 5\sqrt{10}\right)$ and $\left(-1 - \sqrt{\frac{5}{2}}, 29 + 5\sqrt{10}\right)$. [3]

3. Describe the following curves:

   (a) A straight line of gradient 3 with intercept 2. [1]

   (b) A parabola with minimum point $(-1, 0)$ and intercept 1. [2]

   (c) A parabola with minimum point $(-10, -100)$ and intercept 0. [2]

   (d) A straight line of gradient 3 and intercept -1. [1]

   (e) A straight line of gradient 2 that passes through the origin. [1]

   (f) A circle centred at the origin of radius 1. [1]

   (g) A circle centred at the origin of radius 5. [1]

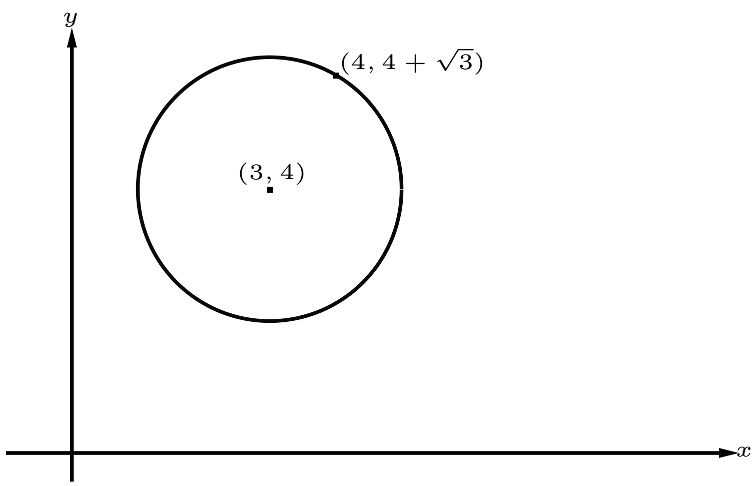
(h) A circle centred at $(2, 5)$ of radius 2. [2]

(i) A circle centred at $(0, 1)$ of radius $\sqrt{5}$. [2]

(j) A circle centred at $(1, 2)$ of radius 2. (*Complete the square to get it in the correct form*) [3]

(k) A circle centred at $(5, 0)$ of radius 7. (*Complete the square to get it in the correct form*) [3]

4. The figure below gives a plot of a circle with unknown equation. You are given that the centre of the circle is $(3, 4)$ and that the point $(4, 4+\sqrt{3})$ lies on the circle.



(a) We know that the centre of the circle is $(4, 3)$ and the so the circle must have equation:

$$(x-3)^2 + (y-4)^2 = r^2,$$

for some unknown radius r. To find r we simply substitute the point $(4, 4+\sqrt{3})$ into the equation. This yields:

$$(4-3)^2 + (4+\sqrt{3}-4)^2 = r^2,$$

Thus, we have that $r = 2$, and so the equation of the circle is:

$$(x-3)^2 + (y-4)^2 = 4.$$

[5]

(b) Simply substitute $(3, 2)$ into the above equation and check that both sides agree. [2]

(c) There are a few ways of getting the answer to this question but we will follow the method suggested in the hint. The line through $(3, 4)$ and $(4, 4+\sqrt{3})$ is calculated to be $y = \sqrt{3}x - 3\sqrt{3} + 4$.

We now substitute $y = \sqrt{3}x - 3\sqrt{3} + 4$ into $(x-3)^2 + (y-4)^2 = 4$. to find the points of intersection:

$$(x-3)^2 + (\sqrt{3}x - 3\sqrt{3} + 4 - 4)^2 = 4,$$

which simplifies to $4x^2 - 24x + 32 = 0$, with solutions $x = 4$ and $x = 2$.

The solution we are looking for is $x = 2$. We substitute $x = 2$ into the equation $y = \sqrt{3}x - 3\sqrt{3} + 4$ to get $y = 4 - \sqrt{3}$, to give the answer:

$$(2, 4 - \sqrt{3}).$$

[4]

(d) The tangent line is perpendicular to $y = \sqrt{3}x - 3\sqrt{3} + 4$ and so we know that the tangent line has gradient $-\frac{1}{\sqrt{3}}$.

Using $y - y_1 = m(x - x_1)$ on the point $(4, 4 + \sqrt{3})$ we get that the tangent line is:

$$y = -\frac{1}{\sqrt{3}}x + \frac{12 + 7\sqrt{3}}{3}.$$

[3]

(e) The circle has been shifted to the left by 3 units. All we need to do is to replace x with $x + 3$ in the equation of the circle. This gives:

$$((x + 3) - 3)^2 + (y - 4)^2 = 4$$

,

which simplifies to give the answer:

$$x^2 + (y - 4)^2 = 4.$$

[1]