# Pure Year 1 exam questions Edexcel

**NOTE**:

*Please be aware that in the Year 12 collections, you will find questions from the Year 13 papers. However, these questions are intentionally included because they align with Year 12 content and topics.*

# Ch. 4: Graphs and Transformations

## June 2024 Question 3 Paper 2 (A-level)

**3.** The point $P(3, -2)$ lies on the curve with equation $y = f(x)$, $x \in \mathbb{R}$

Find the coordinates of the point to which $P$ is mapped when the curve with equation $y = f(x)$ is transformed to the curve with equation

(i) $y = f(x - 2)$

(ii) $y = f(2x)$

(iii) $y = 3f(-x) + 5$

**(4)**

**ANSWER**

| Question | Scheme | Marks | AOs |
|---|---|---|---|
| **3(i)** | $(5, -2)$ **or e.g.** $x = 5, y = -2$ o.e. | B1 | 1.1b |
| | | **(1)** | |
| **(ii)** | $(1.5, -2)$ **or e.g.** $x = 1.5, y = -2$ o.e. | B1 | 1.1b |
| | | **(1)** | |
| **(iii)** | $(-3, \ldots)$ **or** $(\ldots, -1)$ **or** $x = -3$ **or** $y = -1$ o.e. | B1 | 1.1b |
| | $(-3, -1)$ **or** $x = -3$ **and** $y = -1$ o.e. | B1 | 1.1b |
| | | **(2)** | |
| | | | **(4 marks)** |

## June 2024 Question 5

**5.** The curve $C_1$ has equation

$$y = \frac{6}{x} + 3$$

(a) (i) Sketch $C_1$ stating the coordinates of any points where the curve cuts the coordinate axes.

(ii) State the equations of any asymptotes to the curve $C_1$

**(3)**

The curve $C_2$ has equation

$$y = 3x^2 - 4x - 10$$

(b) Show that $C_1$ and $C_2$ intersect when

$$3x^3 - 4x^2 - 13x - 6 = 0$$

**(2)**

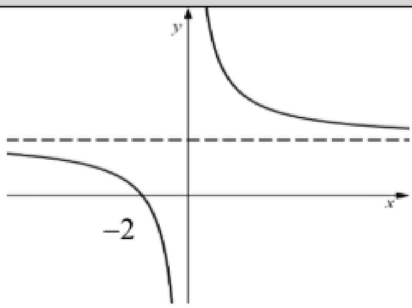
Given that the $x$ coordinate of one of the points of intersection is $-\frac{2}{3}$

(c) use algebra to find the $x$ coordinates of the other points of intersection between $C_1$ and $C_2$

*(Solutions relying on calculator technology are not acceptable.)*

**(4)**

**ANSWER**

| Question | Scheme | Marks | AOs |
|---|---|---|---|
| 5(a)(i) |   | M1<br>A1 | 1.1b<br>1.1b |
| (ii) | Asymptotes: $y = 3, \quad x = 0$ | B1 | 1.1b |
| | | (3) | |
| (b) | e.g. $\frac{6}{x} + 3 = 3x^2 - 4x - 10 \Rightarrow 6 + 3x = 3x^3 - 4x^2 - 10x$ | M1 | 1.1b |
| | $3x^3 - 4x^2 - 13x - 6 = 0 \quad *$ | A1* | 1.1b |
| | | | |
| | | (2) | |
| (c) | e.g. $3x + 2 \overline{\smash{)}3x^3 - 4x^2 - 13x - 6}$ with quotient $x^2 - 2x \pm \ldots$ | M1 | 3.1a |
| | $x^2 - 2x - 3 \ (= 0)$ or $3x^2 - 6x - 9 \ (= 0)$ | A1 | 1.1b |
| | e.g. $(3x+2)(x-3)(x+1) = 0 \Rightarrow x = \ldots$ | dM1 | 1.1b |
| | $x = -1, \ x = 3$ | A1cso | 1.1b |
| | | (4) | |
| | | | **(9 marks)** |

## June 2023 Question 15

**15.** **In this question you must show detailed reasoning.**

**Solutions relying on calculator technology are not acceptable.**

The curve $C_1$ has equation $y = 8 - 10x + 6x^2 - x^3$

The curve $C_2$ has equation $y = x^2 - 12x + 14$

(a) Verify that when $x = 1$ the curves $C_1$ and $C_2$ intersect.

**(2)**

The curves also intersect when $x = k$.

Given that $k < 0$

(b) use algebra to find the exact value of $k$.

**(5)**

**ANSWER**

| Question | Scheme | Marks | AOs |
|---|---|---|---|
| **15 (a)** | Attempts both $y = 8 - 10\times1 + 6\times1^2 - 1^3$ and $y = 1^2 - 12\times1 + 14$ | M1 | 1.1b |
| | Achieves $y = 3$ for both equations and gives a minimal conclusion / statement, e.g., $(1, 3)$ lies on both curves so they intersect at $x = 1$ | A1 | 1.1b |
| | | **(2)** | |
| **(b)** | (Curves intersect when) $x^2 - 12x + 14 = 8 - 10x + 6x^2 - x^3$ <br> $\Rightarrow x^3 - 5x^2 - 2x + 6 = 0$ | M1 | 1.1b |
| | For the key step in dividing by $(x-1)$ <br> $x^3 - 5x^2 - 2x + 6 = (x-1)(x^2 + px \pm 6)$ | dM1 | 3.1a |
| | $x^3 - 5x^2 - 2x + 6 = (x-1)(x^2 - 4x - 6)$ | A1 | 1.1b |
| | Solves $x^2 - 4x - 6 = 0$ <br> $(x-2)^2 = 10 \Rightarrow x = \ldots$ | ddM1 | 1.1b |
| | $x = 2 - \sqrt{10}$ only | A1 | 1.1b |
| | | **(5)** | |
| | | | **(7 marks)** |

## June 2023 Question 4

**4.** (a) Sketch the curve with equation

$$y = \frac{k}{x} \qquad x \neq 0$$

where $k$ is a positive constant.

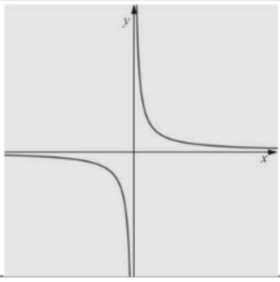
**(2)**

(b) Hence or otherwise, solve

$$\frac{16}{x} \leqslant 2$$

**(3)**

**ANSWER**

| Question | Scheme | Marks | AOs |
|---|---|---|---|
| **4(a)** |  Shape in quadrant 1 **or** 3 | M1 | 1.1b |
| | Shape and Position | A1 | 1.1b |
| | | **(2)** | |
| **(b)** | Deduces that $x < 0$ | B1 | 2.2a |
| | Attempts $\frac{16}{x}...2 \Rightarrow x...\pm\frac{16}{2}$ | M1 | 1.1b |
| | $x < 0$ or $x \geqslant 8$ | A1 cso | 2.2a |
| | | **(3)** | |
| | | | **(5 marks)** |

## June 2022 Question 11 Paper 1 (A Level)

**11.**

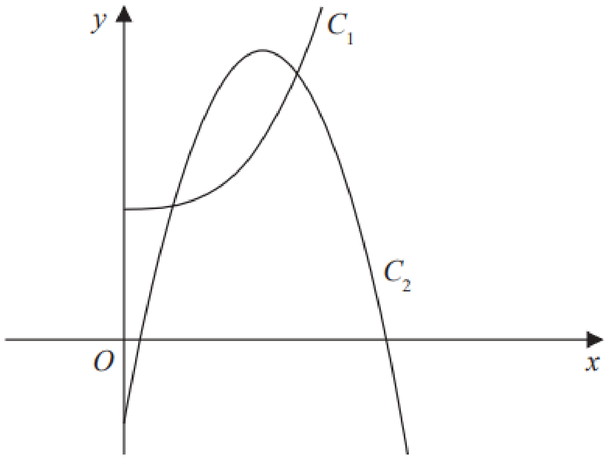



**Figure 4**

Figure 4 shows a sketch of part of the curve $C_1$ with equation

$$y = 2x^3 + 10 \qquad x > 0$$

and part of the curve $C_2$ with equation

$$y = 42x - 15x^2 - 7 \qquad x > 0$$

(a) Verify that the curves intersect at $x = \frac{1}{2}$

**(2)**

The curves intersect again at the point $P$

(b) Using algebra and showing all stages of working, find the exact $x$ coordinate of $P$

**(5)**

**ANSWER**

| Question | Scheme | Marks | AOs |
|---|---|---|---|
| **11 (a)** | Substitutes $x=\frac{1}{2}$ into $y=2x^3+10$ **and** $y=42x-15x^2-7$ and finds the $y$ values for both | M1 | 1.1b |
| | Achieves $\frac{41}{4}$ o.e. for both and makes a valid conclusion. * | A1* | 2.4 |
| | | **(2)** | |
| **(b)** | Sets $42x-15x^2-7=2x^3+10 \Rightarrow 2x^3+15x^2-42x+17=0$ | M1 | 1.1b |
| | Deduces that $(2x-1)$ is a factor and attempts to divide | dM1 | 2.1 |
| | $2x^3+15x^2-42x+17=(2x-1)\left(x^2+8x-17\right)$ | A1 | 1.1b |
| | Solves their $x^2+8x-17=0$ using suitable method | M1 | 1.1b |
| | Deduces $x=-4+\sqrt{33}$ (see note) | A1 | 2.2a |
| | | **(5)** | |
| | | | **(7 marks)** |

Video solution:
https://youtu.be/aUIOj6-F_x8

## June 2022 Question 7

**7.** (a) Factorise completely $9x - x^3$

**(2)**

The curve $C$ has equation

$$y = 9x - x^3$$

(b) Sketch $C$ showing the coordinates of the points at which the curve cuts the $x$-axis.

**(2)**

The line $l$ has equation $y = k$ where $k$ is a constant.

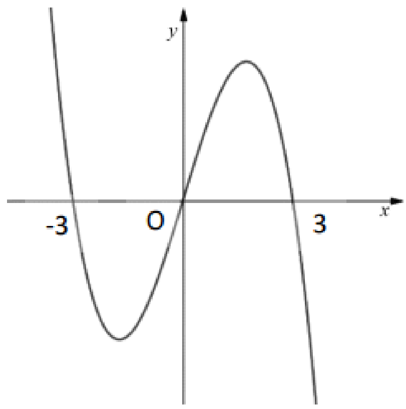
Given that $C$ and $l$ intersect at 3 distinct points,

(c) find the range of values for $k$, writing your answer in set notation.

**Solutions relying on calculator technology are not acceptable.**

**(3)**

## ANSWER

| Question | Scheme | Marks | AOs |
|---|---|---|---|
| 7(a) | $9x - x^3 = x(9 - x^2)$ | M1 | 1.1b |
| | $9x - x^3 = x(3 - x)(3 + x)$ oe | A1 | 1.1b |
| | | **(2)** | |
| **(b)** |   A cubic with correct orientation | B1 | 1.1b |
| | Passes though origin, (3, 0) and (–3, 0) | B1 | 1.1b |
| | | **(2)** | |
| **(c)** | $y = 9x - x^3 \Rightarrow \dfrac{dy}{dx} = 9 - 3x^2 = 0 \Rightarrow x = (\pm)\sqrt{3} \Rightarrow y = \ldots$ | M1 | 3.1a |
| | $y = (\pm)6\sqrt{3}$ | A1 | 1.1b |
| | $\left\{k \in \mathbb{R} : -6\sqrt{3} < k < 6\sqrt{3}\right\}$ oe | A1ft | 2.5 |
| | | **(3)** | |
| | | | **(7 marks)** |

Video solution:

https://youtu.be/SEvw1T8kZbI

## June 2019 Question 7

**7.** The curve $C$ has equation

$$y = \frac{k^2}{x} + 1 \qquad x \in \mathbb{R},\ x \neq 0$$

where $k$ is a constant.

(a) Sketch $C$ stating the equation of the horizontal asymptote.

**(3)**

The line $l$ has equation $y = -2x + 5$

(b) Show that the $x$ coordinate of any point of intersection of $l$ with $C$ is given by a solution of the equation

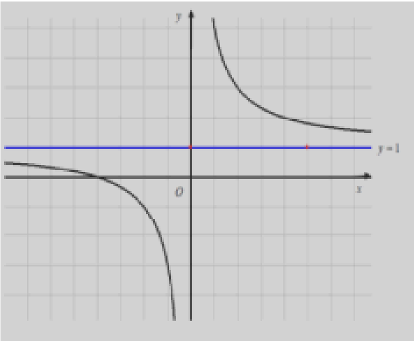
$$2x^2 - 4x + k^2 = 0$$

**(2)**

(c) Hence find the exact values of $k$ for which $l$ is a tangent to $C$.

**(3)**

**ANSWER**

| Question | Scheme | Marks | AOs |
|---|---|---|---|
| 7 (a) |  $\frac{1}{x}$ shape in 1st quadrant | M1 | 1.1b |
| | Correct | A1 | 1.1b |
| | Asymptote $y=1$ | B1 | 1.2 |
| | | **(3)** | |
| **(b)** | Combines equations $\Rightarrow \frac{k^2}{x}+1=-2x+5$ | M1 | 1.1b |
| | $(\times x)\Rightarrow k^2+1x=-2x^2+5x \Rightarrow 2x^2-4x+k^2=0$ * | A1* | 2.1 |
| | | **(2)** | |
| **(c)** | Attempts to set $b^2-4ac=0$ | M1 | 3.1a |
| | $8k^2=16$ | A1 | 1.1b |
| | $k=\pm\sqrt{2}$ | A1 | 1.1b |
| | | **(3)** | |
| | | | **(8 marks)** |

## June 2018 Question 9

**9.** $$g(x) = 4x^3 - 12x^2 - 15x + 50$$

(a) Use the factor theorem to show that $(x + 2)$ is a factor of $g(x)$.

**(2)**

(b) Hence show that $g(x)$ can be written in the form $g(x) = (x + 2)(ax + b)^2$, where $a$ and $b$ are integers to be found.

**(4)**

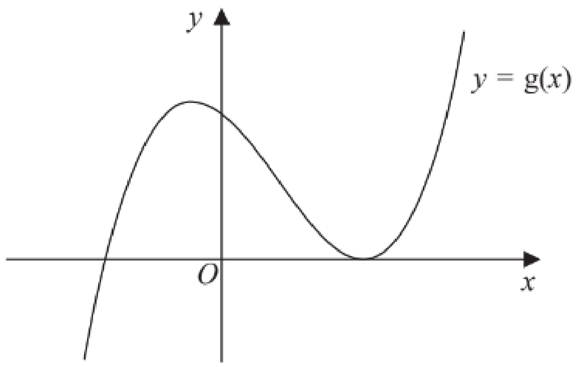



**Figure 2**

Figure 2 shows a sketch of part of the curve with equation $y = g(x)$

(c) Use your answer to part (b), and the sketch, to deduce the values of $x$ for which

(i) $g(x) \leqslant 0$

(ii) $g(2x) = 0$

**(3)**

**ANSWER**

| Question | Scheme | Marks | AOs |
|---|---|---|---|
| **9(a)** | $(g(-2)) = 4\times -8 - 12\times 4 - 15\times -2 + 50$ | M1 | 1.1b |
| | $g(-2) = 0 \Rightarrow (x+2)$ is a factor | A1 | 2.4 |
| | | **(2)** | |
| **(b)** | $4x^3 - 12x^2 - 15x + 50 = (x+2)(4x^2 - 20x + 25)$ | M1<br>A1 | 1.1b<br>1.1b |
| | $= (x+2)(2x-5)^2$ | M1<br>A1 | 1.1b<br>1.1b |
| | | **(4)** | |
| **(c)** | (i) $x \leqslant -2,\ x = 2.5$ | M1<br>A1ft | 1.1b<br>1.1b |
| | (ii) $x = -1,\ x = 1.25$ | B1ft | 2.2a |
| | | **(3)** | |
| | | | **(9 marks)** |