	1.	The curve	C has	equation	y = f(x)	where
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$$f(x) = ax^3 + 15x^2 - 39x + b$$

and a and b are constants.

Given

- the point (2, 10) lies on C
- the gradient of the curve at (2, 10) is -3
- (a) (i) show that the value of a is -2
 - (ii) find the value of b.

(4)

(b) Hence show that *C* has no stationary points.

(3)

(c) Write f(x) in the form (x-4)Q(x) where Q(x) is a quadratic expression to be found.

(2)

(d) Hence deduce the coordinates of the points of intersection of the curve with equation

$$y = f(0.2x)$$

and the coordinate axes.

(2)

2.	(a) Factorise completely $9x - x^3$	(2)
	The curve C has equation	(4)
	$y = 9x - x^3$	
	(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)

2	Δ	curve	has	equation	1, –	f(v		v > 0	١
J	. A	Curve	Has	equation	y =	I(X),	$x \neq 0$	J

Given that

- $f'(x) = 4x + a\sqrt{x} + b$, where a and b are constants
- the curve has a stationary point at (4,3)

the course meets the marie of 5	
• the curve meets the y-axis at -5	
find $f(x)$, giving your answer in simplest form.	(6)

(3)

4. The curve *C* has equation

$$y = 5x^4 - 24x^3 + 42x^2 - 32x + 11 \qquad x \in \mathbb{R}$$

- (a) Find
 - (i) $\frac{\mathrm{d}y}{\mathrm{d}x}$
 - (ii) $\frac{d^2y}{dx^2}$
- (b) (i) Verify that C has a stationary point at x = 1
 - (ii) Show that this stationary point is a point of inflection, giving reasons for your answer.

(4)

5.

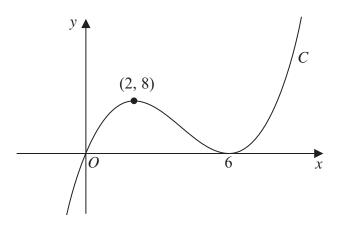


Figure 1

Figure 1 shows a sketch of a curve C with equation y = f(x) where f(x) is a cubic expression in x.

The curve

- passes through the origin
- has a maximum turning point at (2, 8)
- has a minimum turning point at (6, 0)
- (a) Write down the set of values of x for which

$$f'(x) < 0 \tag{1}$$

The line with equation y = k, where k is a constant, intersects C at only one point.

(b) Find the set of values of k, giving your answer in set notation.

(2)

(c) Find the equation of C. You may leave your answer in factorised form.

(3)

6.

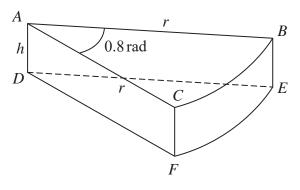


Figure 5

A company makes toys for children.

Figure 5 shows the design for a solid toy that looks like a piece of cheese.

The toy is modelled so that

- face ABC is a sector of a circle with radius rcm and centre A
- angle BAC = 0.8 radians
- faces ABC and DEF are congruent
- edges AD, CF and BE are perpendicular to faces ABC and DEF
- edges AD, CF and BE have length h cm

Given that the volume of the toy is 240 cm³

(a) show that the surface area of the toy, $S \text{ cm}^2$, is given by

$$S = 0.8r^2 + \frac{1680}{r}$$

making your method clear.

(4)

Using algebraic differentiation,

(b) find the value of r for which S has a stationary point.

(4)

(c) Prove, by further differentiation, that this value of *r* gives the minimum surface area of the toy.

(2)