25 The derivative of $2ax^7 + 3x^k$ is $42x^6 + 15x^{k-1}$.

Find the value of a and the value of k.

$a =$ .....

$k =$ ..... [2]

25	$a = 3$ $k = 5$	**2**	**B1** for each or **M1** for $2 \times 7ax^6 + 3kx^{k-1}$ or better

11 **(a)** Differentiate $x^3 - 4x^2 - 3x$.

..... [2]

(b) A curve has equation $y = x^3 - 4x^2 - 3x$.

Work out the coordinates of the two stationary points.
Show all your working.

(..... , ...)

(..... , ...) [5]

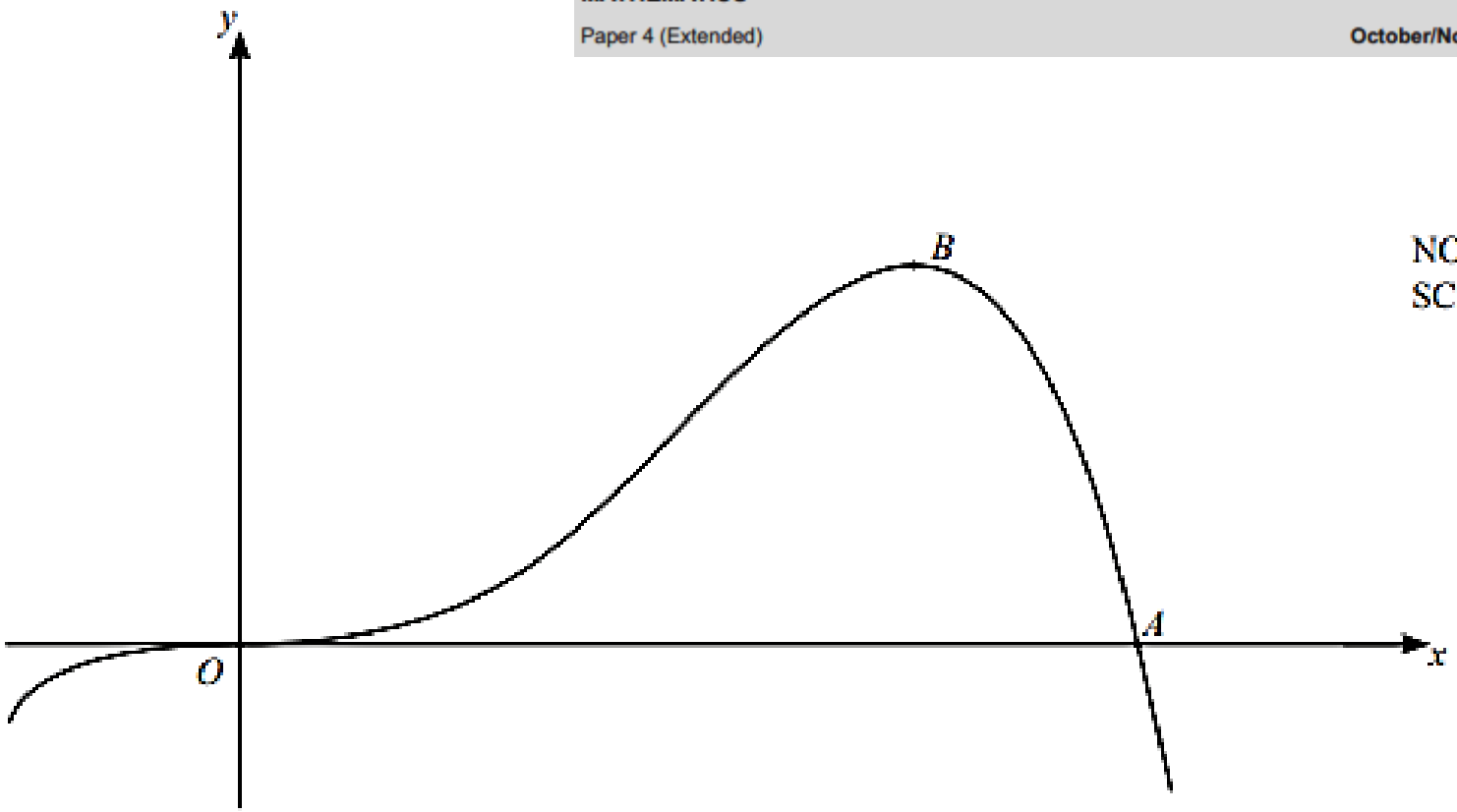
(c) Determine whether each stationary point is a maximum or a minimum.
Show all your working.

[3]

11(a)	$3x^2 - 8x - 3$	**2**	**B1** for two terms correct or correct answer seen
11(b)	$3x^2 - 8x - 3 = 0$	**M1**	**FT** their **part (a)**
	Correct method to solve their 3-term quadratic $(3x + 1)(x - 3)$ [=0] $\frac{-(-8) \pm \sqrt{(-8)^2 - 4(3)(-3)}}{2(3)}$	**M2**	**M1** for $(3x + a)(x + b)$ [=0] where $ab = -3$ or $3b + a = -8$ or for $\sqrt{(-8)^2 - 4(3)(-3)}$ or for $\frac{p \pm \sqrt{q}}{r}$ where $p = -(-8)$ and $r = 2(3)$ seen or for a correct method for solving a 2-term quadratic
	$(3, -18)$ $\left(-\frac{1}{3}, \frac{14}{27}\right)$	**B2**	**B1** for one correct point or for two correct x-values, or **M1** for substitution of *their* x-values into $y = x^3 - 4x^2 - 3x$ **shown**

11(c)	(3, –18) minimum with reason $\left(-\frac{1}{3}, \frac{14}{27}\right)$ maximum with reason	**3**	Reasons could be e.g. 1. A reasonable sketch of a positive cubic 2. Correct use of 2nd derivative = $6x - 8 = 10$, $10 > 0$, so (3, –18) is a minimum oe. 2nd derivative = $6x - 8 = -10$, $-10 < 0$ so $\left(-\frac{1}{3}, \frac{14}{27}\right)$ is a maximum oe. 3. Evaluates correctly values of y on both sides of both correct stationary points 4. Finds gradient on each side of both correct stationary points. **B2** for 1 correct with a reason for that stationary point or for **both** x-values correct with correct conclusions and reasonable sketch of a positive cubic, or for correct substitution of **both** of *their* x-values into *their* second derivative shown, or substitution shown for one x-value either side of **both** of *their* stationary points to find the gradients. Or **M1** for showing [2nd derivative =] $6x - 8$ or substitution shown for one x-value either side of **one** of *their* stationary points to find the gradients.

9



The diagram shows a sketch of the graph of $y = 4x^3 - x^4$.
The graph crosses the x-axis at the origin O and at the point A.
The point B is a maximum point.

(a) Differentiate $4x^3 - x^4$.

..... [2]

(b) Find the coordinates of B.

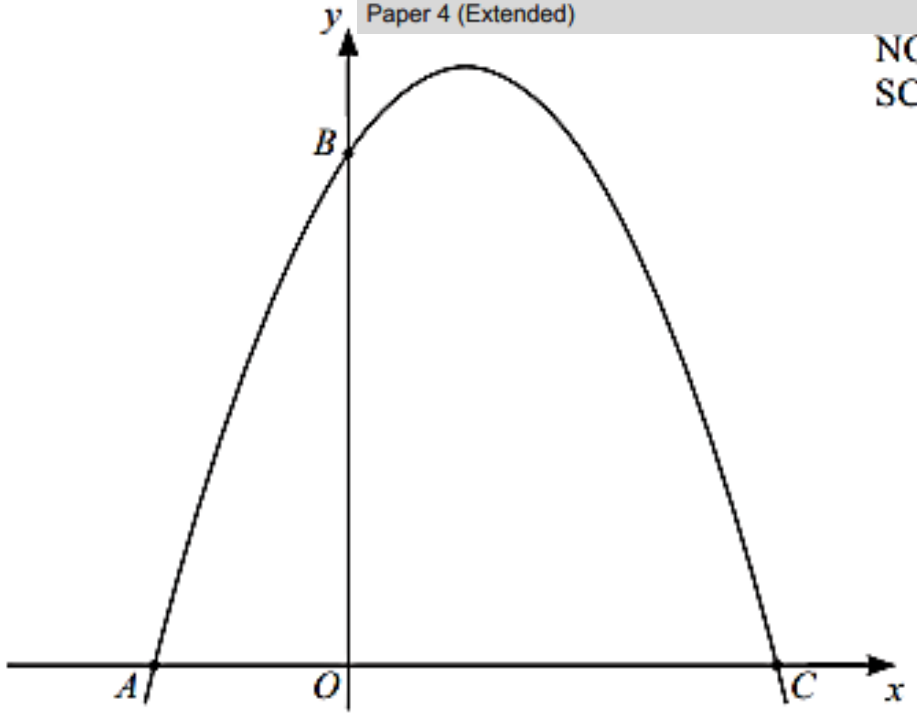
(..... , ...) [3]

(c) Find the gradient of the graph at the point A.

..... [3]

9(a)	$12x^2 - 4x^3$ oe final answer	**2**	**B1** for $12x^2$ or $-4x^3$ in final answer or for correct answer seen
9(b)	(3, 27)	**3**	**B2** for $x = 3$ OR **M1** for *their* $12x^2 - 4x^3 = 0$ or better or states $\frac{dy}{dx} = 0$ **M1dep** for substituting *their* x into $y = 4x^3 - x^4$ shown

11



The diagram shows a sketch of $y = 18 + 5x - 2x^2$.

(a) Find the coordinates of the points A, B and C.

A (..... , ...)

B (..... , ...)

(b) Differentiate $18+5x-2x^2$.

..... [2]

(c) Find the coordinates of the point on $y=18+5x-2x^2$ where the gradient is 17.

(..... , ...) [3]

11(a)	(–2, 0) (0, 18) (4.5, 0) oe	**4**	**B1** for $B = (0, 18)$ **B3** for $A = (–2, 0)$ and $C = (4.5, 0)$ oe or **B2** for $x = –2$ and $x = 4.5$ oe or **B1** for $(9 – 2x)(2 + x)$ oe or either A or C correct
11(b)	$5 – 4x$ final answer	**2**	**B1** for one correct term when simplified
11(c)	(– 3, –15)	**3**	**B2FT** for $x = – 3$ OR **M1** for *their* **(b)** = 17 **M1 dep** for correct substitution of *their* x into $18 + 5x – 2x^2$ shown

10 $y = x^7 - 7x^6$

(a) Find the derivative of y with respect to x.

..... [2]

(b) Find the equation of the tangent to the graph of $y = x^7 - 7x^6$ at the point where $x = -1$.
Give your answer in the form $y = mx + c$.

$y =$ ..... [4]

(c) The graph of $y = x^7 - 7x^6$ has two turning points.

Find the coordinates of these points.
You must show all your working.

(..... , ...)

(..... , ...) [5]

10(a)	$7x^6 - 42x^5$ final answer	**2**	**B1** for one correct term $7x^6$ or $42x^5$ or for $7x^6 - 42x^5$ seen and spoiled
10(b)	$49x + 41$	**4**	**M1** for substituting $x = -1$ into $[y =] x^7 - 7x^6$ **M1** for $x = -1$ substituted in *their* (a) or the correct derivative to give *their m* **M1** for *their* $-8 = (\textit{their } m)(-1) + c$ oe
10(c)	(0, 0) (6, –46 656)	**5**	**B4** for (6, –46 656) or **B3** for $x = 0$ and 6 **OR** **M1** for *their* $\frac{dy}{dx} = 0$ or stating $\frac{dy}{dx} = 0$ and **M1** for a correct method to solve *their* $7x^6 - 42x^5$