# Higher Still Mathematics

HIGHER GRADE
Paper I

November Prelim
*45 minutes*

**All questions should be attempted**

*Marks*

1. A function is defined by the formula

$$f(x) = 4x^2(x-3), \quad x \in R$$

(a) Write down the coordinates of the points where the curve with equation $y = f(x)$ meets the coordinate axes. (2)

(b) Find the stationary points of $y = f(x)$ and determine the nature of each. (6)

(c) Sketch and annotate the curve $y = f(x)$ (2)

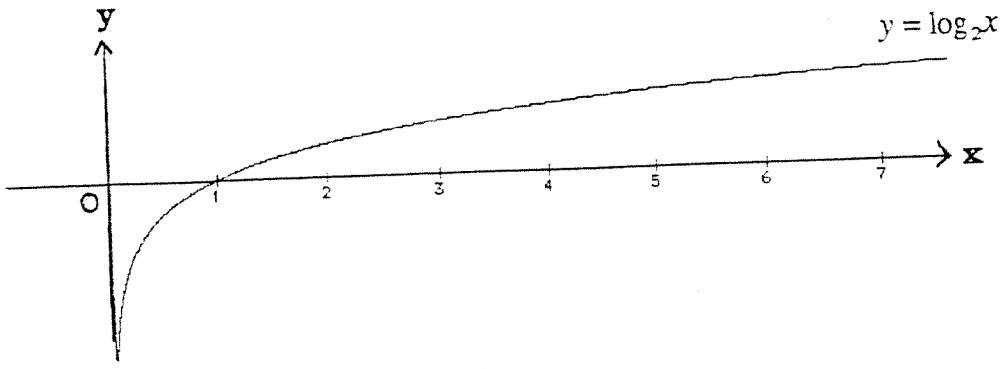
2. A mushroom grower harvests 20% of her stock at the end of every week. During the week another 100 mushrooms will become ready for picking.

(a) Write a recurrence relation to model the situation, using $u_n$ to represent the number of mushrooms ready for picking at the start of each week.

(b) If growing conditions are maintained, comment on long-term levels of the mushroom crop. (4)

3. Differentiate $3x^{\frac{1}{2}} + \frac{2}{\sqrt{x}}$ with respect to $x$. (2)

4. The diagram below shows a sketch of the graph of $y = f(x)$, where $f(x) = \log_2 x$

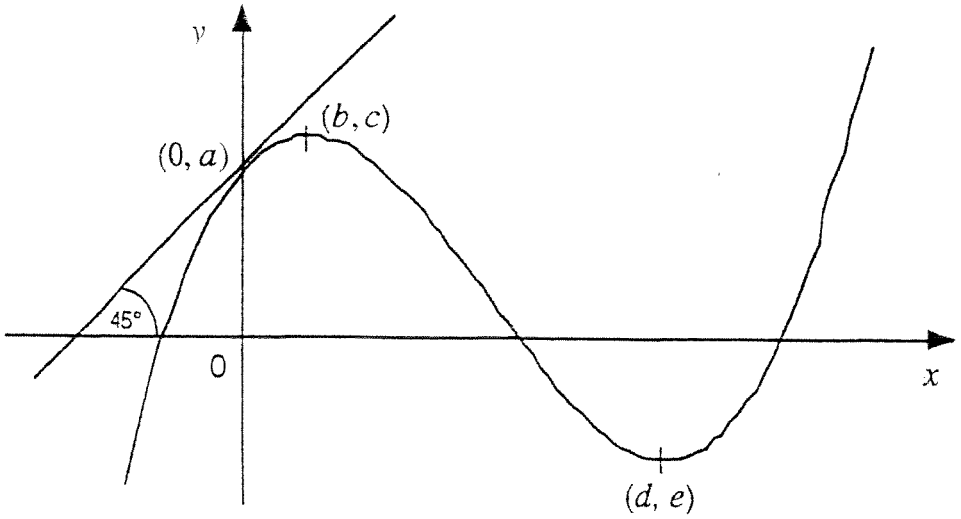



Make a copy of this graph. (Your copy need not be exact). (3)

On your copy, sketch and annotate the graph of $y = f^{-1}(x)$, the inverse of $f(x)$.

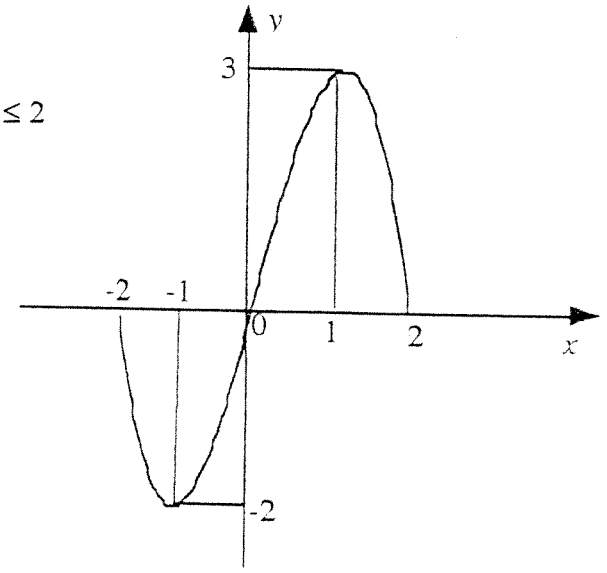
5. The diagram below shows the graph of a cubic function $f$ which has

(i) a maximum turning point at $(b, c)$
(ii) a minimum turning point at $(d, e)$, and
(iii) a tangent, at the point $(0, a)$, inclined at 45° to the $x$-axis.




(a) State the values of $f'(b), f'(d)$ and $f'(0)$. (2)
(b) Sketch the graph of the derived function $f'(x)$. (2)

6. The graph of $y = f(x)$ for $-2 \leq x \leq 2$ is indicated. On separate axes sketch and annotate the graphs of:




(a) $y = -f(x)$,
(b) $y = 3 + f(x)$. (4)

7. Find the exact values of:

(a) $\cos\frac{\pi}{4}$ (1)

(b) $2\tan^2\frac{\pi}{4} - 2\cos^2\frac{\pi}{4}$ (3)

*[END OF QUESTION PAPER]*