

Revision: Algebra, functions and Equations (Topics 1 & 2)**Coursebook chapters: 1–7****1. Do not use a calculator to answer this question.**Solve the equation $\log_3(2x + 1) = 2$.*(accessible to students on the path to grade 3 or 4) [4 marks]***2. Find the first three terms in the binomial expansion of $\left(\frac{x}{3} - 2\right)^6$.***(accessible to students on the path to grade 3 or 4) [5 marks]***3. The function f is defined by $f(x) = \frac{1}{2} \ln(3x)$ for $x > 0$.**

- (a) State the range of f .
- (b) Find an expression for $f^{-1}(x)$.
- (c) Find the exact solution of the equation $f(x) = 5$.

*(accessible to students on the path to grade 3 or 4) [5 marks]***4. $f(x) = ax^3 - x^2 + 2x + b$** The remainder when $f(x)$ is divided by $(x + 2)$ is 5 and the remainder when $f(x)$ is divided by $(2x - 1)$ is 3.Find the values of a and b .*(accessible to students on the path to grade 3 or 4) [5 marks]***5. Do not use a calculator to answer this question.**

- (a) Write $x^2 - 3x + 5$ in the form $(x - p)^2 + q$.

- (b) Hence find the range of the quadratic function $f(x) = \frac{1}{x^2 - 3x + 5}$.

(accessible to students on the path to grade 5 or 6) [5 marks]

6. Find the exact values of k for which the equation $kx^2 - 4x + (k + 1) = 0$ has equal roots.

(accessible to students on the path to grade 5 or 6) [5 marks]

7. Arun and Bea are starting training for a swimming race. On the first day they both swim 500 m .
On each subsequent day, Arun swims 25 m more than the previous day, and Bea swims 5% farther than on the previous day.

- (a) Find the total distance Arun will swim over the first 20 days.
- (b) On which day will Bea first swim more than 1000 m?
- (c) After how many days will Bea have swum a total of 5000 m more than Arun?

(accessible to students on the path to grade 5 or 6) [9 marks]

8. **Do not use a calculator to answer this question.**

Two functions are defined by $f(x) = 3x^2$ and $g(x) = 4e^x + 1$.

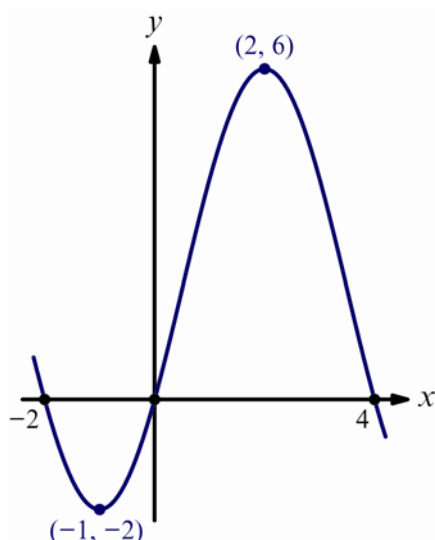
- (a) State the range of $g(x)$
- (b) Solve the equation $f(g(x)) = 75$.

(accessible to students on the path to grade 5 or 6) [8 marks]

9.
 - (a) Show that $(x - 3)$ is a factor of $p(x) = 2x^3 - 5x^2 - 6x + 9$.
 - (b) Factorise $p(x)$ completely.
 - (c) Hence sketch the graph of $y = p(x)$.

(accessible to students on the path to grade 5 or 6) [9 marks]

10. The graph of $y = f(x)$ is shown in the diagram.



- (a) Sketch the graph of $y = 3f(-x)$ showing the coordinates of all the zeros and turning points.
- (b) Sketch the graph of $f(2x) + 1$, showing the coordinates of the y -intercept and turning points.

(accessible to students on the path to grade 5 or 6) [6 marks]

11. Solve the equation $2^x - 4 \times 2^{-x} = 3$.

(accessible to students on the path to grade 7) [5 marks]

12. For the rational function $f(x) = \frac{x+a}{2x-b}$,

- (a) State the equation of the vertical asymptote.
- (b) In the case $a = 3$, $b = 5$, solve the equation $f(x) = f^{-1}(x)$.

(accessible to students on the path to grade 7) [5 marks]