Short answer

1 Given the function $f(x) = 3x^3 - 2x^2 + 3x - 6$, find: **2.1**

(a) $f(3)$ **(b)** $f(-1)$ **(c)** $f(a)$ **(d)** $f(3b)$

2 Expand each of the following expressions and simplify. **2.2**

(a) $3(a + 2) + 4(a - 5)$ **(b)** $4(x - 3) + 3(x^2 + 2x - 1)$ **(c)** $(x - 3)(x + 2)$

(d) $(2m + 1)(m - 3)$ **(e)** $(x + 4)^2$ **(f)** $(2x - 3)(2x + 3)$

3 Factorise each of the following. **2.3**

(a) $5x^2 + 10x$ **(b)** $24m^2 - 6mn$ **(c)** $15a^2b - 3a^3b^2 + 6ab$

4 Factorise each of the following. **2.3**

(a) $x^2 + 2x - 3$ **(b)** $2x^2 - 5x - 12$ **(c)** $-2x^2 - x + 1$

5 Factorise each of the following. **2.4**

(a) $4x^2 - 25$ **(b)** $x^2 + 8x + 16$ **(c)** $a^2 - 6a + 9$

6 Factorise by completing the square: **2.5**

(a) $x^2 - 4x + 2$ **(b)** $x^2 - 7x + 3$ **(c)** $2x^2 - 4x - 7$

7 Solve each of the following quadratic equations. **2.6**

(a) $(x - 4)(x + 3) = 0$ **(b)** $x^2 - 4x = 0$ **(c)** $y^2 - 4y + 3 = 0$

8 Find exact solutions for these equations. **2.7**

(a) $x^2 + 8x + 5 = 0$ **(b)** $(x - 2)^2 - 25 = 0$ **(c)** $x^2 - 6x = -5$

9 Find exact solutions to the equation $x^2 + 5x = 7$. **2.8**

10 Use the discriminant to determine the type of solution to the equation $2x^2 - 7x + 6 = 0$. Find the solutions if they exist, and hence find the x-coordinate of the turning point of the parabola with equation $y = 2x^2 - 7x + 6$. **2.9**

11 State the translations required of the graph of $y = x^2$ to obtain the graph of each of the following functions. **2.10**

(a) $y = (x + 3)^2 + 4$ **(b)** $y = (x - 3)^2 - 2$ **(c)** $y = x^2 + 4x - 3$

12 **(a)** Sketch the graph of the quadratic function $f(x) = x^2 + 6x + 2$. **2.11**

(b) What is the range of this function?

13 Sketch the graph of the function f: $[0, \infty) \rightarrow R$, where $f(x) = -2(x - 1)^2 + 3$. **2.11**

14 By sketching the graph of $y = x^2 + 6x + 13$ over the domain $[-4, 0]$, find the minimum value that $x^2 + 6x + 13$ can take. **2.12**

15 If $y = x^2 + 5x - 7$: **2.13**

(a) state the coordinates of the y-intercept

(b) find the exact coordinates of the x-intercepts

(c) find the exact coordinates of the turning point.

16 On the same set of axes, sketch the graphs of the line $y = 2x + 6$ and the parabola $y = x^2 + 3x + 3$. Hence find the approximate solutions to the simultaneous equations $y = 2x + 6$ and $y = x^2 + 3x + 3$. **2.14**

Multiple choice

17 If $f(x) = 2 - \sqrt{x}$, then $f(4)$ is: 2.1

A 2 **B** 0 **C** –2 **D** undefined **E** 4

18 Which one of the following is *not* a quadratic polynomial? 2.1

A $x^2 - 4$ **B** $\frac{1}{1 + 2x + x^2}$ **C** $3x^2 + 3x + 6$ **D** $x(x - 7)$ **E** $4 - 4x + 4x^2$

19 $(2x + 5)(x - 2)$ is equal to: 2.2

A $2x^2 - 5x + 10$ **B** $2x^2 - 10$ **C** $2x^2 + 5x - 10$ **D** $2x^2 - x - 10$ **E** $2x^2 + x - 10$

20 A common factor of the expression $12x^4 + 6x^3 - 24x^2$ is: 2.3

A 2 **B** $3x^2$ **C** x **D** $6x$ **E** all of these

21 Which of the following is *not* a perfect square? 2.4

A $4x^2 - 4x + 1$ **B** $x^2 + 6x + 9$ **C** $25 - 10y + y^2$ **D** $x^2 + 2x + 1$ **E** $x^2 - 8x - 16$

22 For $(x^2 - x + a)$ to be a perfect square, a is equal to: 2.5

A 1 **B** $\frac{1}{4}$ **C** $-\frac{1}{4}$ **D** $-\frac{1}{2}$ **E** $\frac{1}{2}$

23 Which of the following is *not* a factor of $4x^2 - 20$? 2.5

A 2 **B** $x - \sqrt{10}$ **C** $x - \sqrt{5}$ **D** 4 **E** $x + \sqrt{5}$

24 The solution to the equation $x^2 + 9 = 6x$ is: 2.6

A -3 **B** 3 **C** both 3 and -3 **D** no solution **E** 0

25 One solution to the quadratic equation $14x^2 + 15x = 11$ is: 2.7

A $\frac{11}{14}$ **B** 11 **C** $-\frac{1}{2}$ **D** $-\frac{11}{7}$ **E** 2

26 Using the quadratic formula, the solution to the equation $3x^2 - 2x + 1 = 0$ is: 2.8

A $\frac{1}{2}, \frac{1}{6}$ **B** $-\frac{1}{2}, -\frac{1}{6}$ **C** $\frac{2 \pm \sqrt{6}}{3}$ **D** $\frac{-2 \pm \sqrt{6}}{3}$ **E** no solution

27 The equation $2x^2 - 3x + 5 = 0$ has: 2.9

A no solution **B** one solution **C** two real solutions
D two rational solutions **E** both C and D

28 A value of Δ that is 49 indicates that a quadratic equation has: 2.9

A no solution **B** one solution **C** two real solutions
D two rational solutions **E** both C and D

29 Compared to the basic parabola $y = x^2$, the graph of $y = (x - 3)^2$ has been shifted: 2.10

A down by 3 **B** up by 3 **C** to the left by 3
D to the right by 3 **E** none of these

30 The graph of the function $f(x) = -3(x - 2)^2 - 2$ has a turning point which is: 2.10

A a maximum at (-2, -2) **B** a maximum at (2, 6) **C** a minimum at (-2, -2)
D a minimum at (2, -2) **E** a maximum at (2, -2)

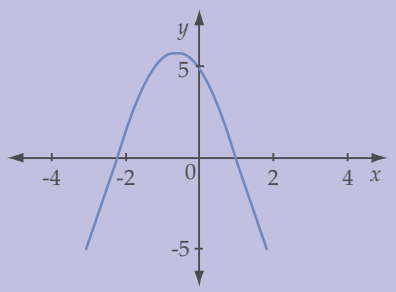
31 If $y = x^2 - 6x + 11$ is changed to the form $y = a(x - h)^2 + k$, then the values of a, h and k are: 2.11

A $a = 1$, $h = -6$ and $k = 2$ **B** $a = 1$, $h = -3$ and $k = -2$ **C** $a = 1$, $h = 3$ and $k = 2$
D $a = 1$, $h = 3$ and $k = -15$ **E** $a = 1$, $h = -3$ and $k = 2$

32 The graph of $y = 2x^2 - 5x + c$ will have two x-intercepts if: 2.12

A $c = \frac{25}{8}$ **B** $c = 23$ **C** $c > \frac{25}{8}$ **D** $c < \frac{25}{4}$ **E** $c < \frac{25}{8}$

33 The graph of $y = -2x^2 - 2x + c$ as shown at right suggests that a positive solution of the equation $-2x^2 - 2x + c = 0$ is approximately: **2.13**



A 1.5 **B** -2 **C** 2
D 5 **E** 1.15

34 One solution to the simultaneous equations **2.14**

$$y = x + 3$$
$$y = x^2 - x - 12$$

is:

A (-5, 8) **B** (3, 6) **C** (5, 8) **D** (1, 4) **E** (0, -3)

35 The line $y = x + 1$ intersects the parabola $y = 4x^2 + 5x + 2$: **2.14**

A never **B** at one point **C** at two points **D** at (0, 0) **E** on the x-axis

Short answer

1 Simplify each of the following. 9.1

(a) $\dfrac{a^{3x} \times a^{x+2}a^{-3}}{a^{4x+1}a^{2}}$ **(b)** $\dfrac{(x^3)^2x^{2x+1}y^4}{x^{3x-1}(y^{x+2})^3}$

2 Expand and simplify $(x^{-3} + y^2)(\dfrac{1}{x} + \dfrac{3x}{y})$. 9.2

3 Express over a common denominator: 9.2

(a) $\dfrac{1}{x+2} + \dfrac{1}{x}$ **(b)** $\dfrac{1}{x} + \dfrac{1}{x^{-1}-2}$ **(c)** $\dfrac{1}{x^{-2}-4} + \dfrac{1}{x+2}$

4 Solve for x. 9.3

(a) $2^x = 32$ **(b)** $3^{x+5} = 81$ **(c)** $2^{2x} - 3(2^x) + 2 = 0$

5 Sketch the graph of $y = 0.8^t + 1$, $t \geqslant 0$, labelling axial intercepts and giving the equation(s) of asymptotes. 9.4

6 **(a)** Express the following in their equivalent logarithmic form. 9.5

(i) $4^0 = 1$ **(ii)** $x^y = b$ **(iii)** $0.01 = 10^{-2}$

(b) Express the following in their equivalent indicial form.

(i) $\log_3 27 = 3$ **(ii)** $\log_{10} 0.1 = -1$ **(iii)** $\log_x b = y$

7 Simplify each of the following expressions. 9.6

(a) $\log_3 5 + \log_3 (x + 1)$ **(b)** $\dfrac{\log_{10} x^5}{\log_{10} \sqrt{x}} + \log_{10} \sqrt{x}$ **(c)** $\dfrac{\log_{10}(x+1)^2}{\log_{10}(x+1)}$

8 Solve for x (correct to three decimal places where appropriate). 9.7

(a) $\log_2 32 = x$ **(b)** $\log_3 81 = x + 4$ **(c)** $\log_x 7 = 2.5$

9 Solve for x. 9.7

(a) $\log_{10} (x + 3) - \log_{10} 2 = 2$ **(b)** $\log_3 x + 2 \log_3 5 = \log_3 (5x + 1)$

10 Solve for x (correct to two decimal places). 9.8

(a) $2^x = 7$ **(b)** $(0.3)^x = 5$ **(c)** $3^{-x} \leqslant 4$

11 Solve $\dfrac{3^x \times 9^{2x-1} \times 12^{1-x}}{(18)^{-2x}} = 2$ 9.8