Intermediate 2 – Revision
Unit 3

1. Simplify

   (a) $\dfrac{3}{x} \times \dfrac{x}{9}$ (b) $\dfrac{ac}{5} \times \dfrac{15}{c}$ (c) $\dfrac{x^2}{w} \times \dfrac{3w}{x}$ (d) $\dfrac{4}{x+1} \times \dfrac{(x+1)^2}{6}$

   (e) $\dfrac{uw}{v} \div \dfrac{u}{5}$ (f) $\dfrac{(x-2)^2}{x} \div \dfrac{x-2}{3x}$ (g) $\dfrac{3xy}{w} \div \dfrac{9x}{w^2}$

2. Express as a single fraction

   (a) $\dfrac{3}{x} + \dfrac{4}{y}$ (b) $\dfrac{a}{c} - \dfrac{c}{5}$ (c) $\dfrac{u}{w} + \dfrac{w}{u}$ (d) $\dfrac{3}{x} - \dfrac{1}{x^2}$

   (e) $\dfrac{2}{a^2} + \dfrac{3}{a^3}$ (f) $\dfrac{4}{x} + \dfrac{2}{x+1}$ (g) $\dfrac{6}{3x-2} - \dfrac{2}{x}$ (h) $\dfrac{4}{2a-1} - \dfrac{2}{a+3}$

3. (a) Express $\dfrac{5}{x-3} + \dfrac{3}{x-1}$ $x \neq 1,3$ as a single fraction in its simplest form

   (b) Express $\dfrac{4}{x^2} + \dfrac{1}{x}$ $x \neq 0$ as a single fraction in its simplest form.

4. (a) Express $y = 4x + c$ in terms of x.   (b) Express $P = 3(2a - 4d)$ in terms of a.

   (b) Express $H = ax^2 + m$ in terms of x.   (d) Express $M = \dfrac{4uw}{v}$ in terms of w.

   (e) Express $P = \frac{1}{2}ac + d$ in terms of a.   (f) Express $T = u + \dfrac{v}{w}$ in terms of v.

   (g) Express $D = \dfrac{m}{n} - p$ in terms of n.   (h) Express $G = \sqrt{u + v^2}$ in terms of v.

5. Simplify

   (a) $\sqrt{27} + 2\sqrt{3} - \sqrt{12}$ (b) $\sqrt{200} - 2\sqrt{20} + \sqrt{18}$ (c) $7\sqrt{45} - 2\sqrt{500}$

   (d) $\sqrt{3}(\sqrt{3} + 3)$ (e) $\sqrt{2}(\sqrt{6} - 2\sqrt{2})$ (f) $(\sqrt{3} + \sqrt{2})(\sqrt{3} - \sqrt{2})$

6. Express with a rational denominator in its simplest form

   (a) $\dfrac{2}{\sqrt{5}}$ (b) $\dfrac{3}{\sqrt{2}}$ (c) $\dfrac{6}{\sqrt{3}}$ (d) $\dfrac{21}{\sqrt{7}}$ (e) $\dfrac{9}{2\sqrt{3}}$ (f) $\dfrac{\sqrt{5}}{\sqrt{15}}$ (g) $\dfrac{2\sqrt{3}}{\sqrt{18}}$

7. (a) $f(x) = \dfrac{6}{\sqrt{x}}$. Express f(10) with a rational denominator in its simplest form.

(b) $g(x) = \dfrac{8}{\sqrt{x}}$. Express g(6) with a rational denominator in its simplest form.

8. Simplify

(a) $3p^6 \times 2p^2$ (b) $2a^5 \times 5a^{-2}$ (c) $7n^{-4} \times 2n^2$ (d) $15m^7 \div 3m^4$

(e) $24x^5 \div 3x^{-2}$ (f) $\dfrac{4a^6 \times 3a^{-2}}{2a}$ (g) $\dfrac{8x^{-3} \times 3x^7}{6x^{-2}}$ (h) $5a^{\frac{1}{2}} \times 4a^{\frac{3}{2}}$

(i) $4p^{\frac{3}{4}} \div 2p^{\frac{1}{4}}$ (j) $\dfrac{n^{\frac{5}{2}} \times n^{\frac{3}{2}}}{n^2}$ (k) $\dfrac{(4m^{\frac{3}{2}})^2}{2m}$ (l) $\dfrac{(3x^{\frac{5}{3}})^3}{9x}$

9. Expand the brackets and simplify

(a) $x(3x^3 - x^{-2})$ (b) $2a^3(3a^2 + 5a^{-3})$ (c) $b^{\frac{1}{2}}(b^{\frac{3}{2}} - 2b^{-\frac{1}{2}})$ (d) $u^{\frac{2}{3}}(u - u^{-\frac{2}{3}})$

10. Evaluate

(a) $27^{\frac{1}{3}}$ (b) $16^{\frac{3}{4}}$ (c) $8^{\frac{2}{3}}$ (d) $16^{-\frac{1}{2}}$ (e) $32^{-\frac{3}{5}}$ (f) $1000^{-\frac{2}{3}}$

11. (a) Evaluate $4a^{\frac{3}{2}}$ when a = 9

(b) Evaluate $2x^{\frac{3}{4}}$ when x = 81

(c) Given n = 32 find the value of $16n^{-\frac{2}{5}}$

12. Solve

(a) $x^2 - 7x = 0$ (b) $2p^2 = 4p$ (c) $m^2 - 36 = 0$ (d) $3y^2 - 12 = 0$

(e) $x^2 - 7x + 12 = 0$ (f) $n^2 - 2n - 8 = 0$ (g) $a^2 = 3a + 10$ (h) $2w^2 - 5w - 7 = 0$

(i) $3u^2 + 10u + 8 = 0$ (j) $6x^2 - 7x = 5$

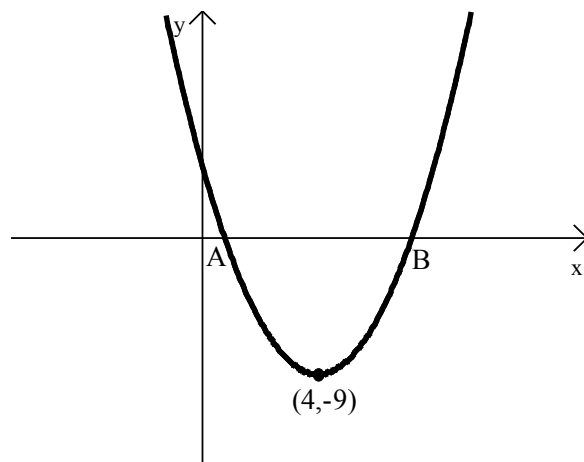13. (a) Solve the equation $3x^2 + 7x + 1 = 0$, giving your answers correct to one decimal place.
(b) Solve the equation $2x^2 - 8x + 3 = 0$, giving your answers correct to three significant figures.
(c) Solve the equation $x^2 - 4x - 7 = 0$, using an appropriate formula.

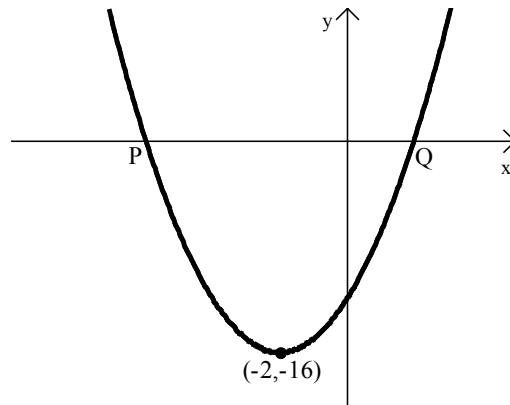14. Each quadratic function below has an equation in the form $y = ax^2$. Write down the equation of each function.

(a) $y = ax^2$ (b)

(2,12)

(3,-36)

$y = ax^2$

(c) $y = ax^2$ (d)

(-2,8)

(-1,-8)

$y = ax^2$
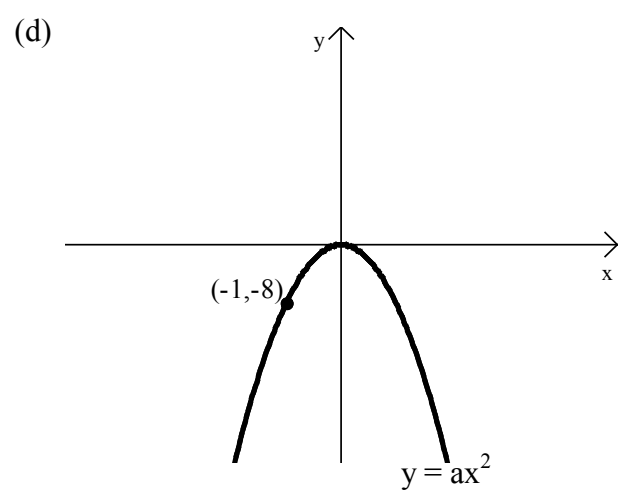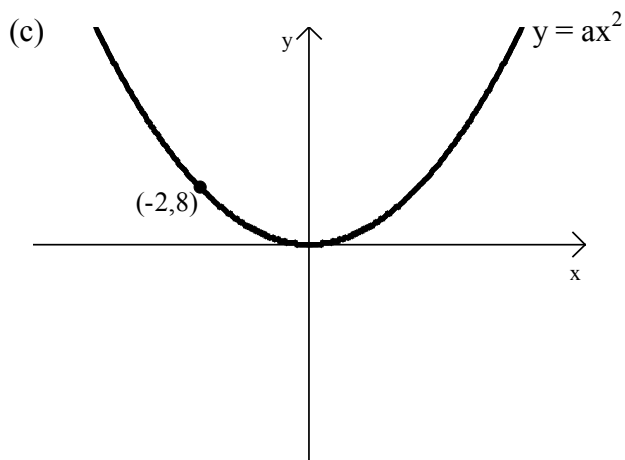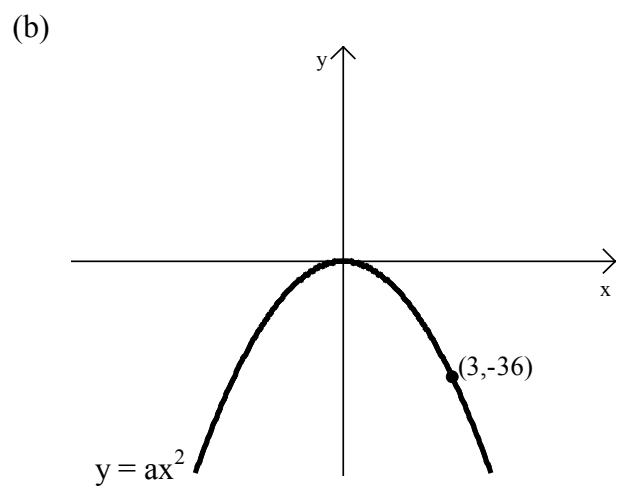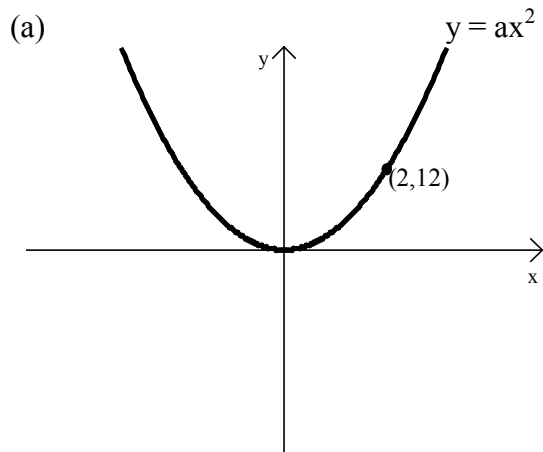
15. The diagram below shows the graph of $y = (x + p)^2 + q$.

A   B   x

(4,-9)

   (a) Write down the values of p and q.
   (b) State the equation of the axis of symmetry.
   (c) Find the coordinates of A and B.

16. The diagram below shows the graph of $y = (x + a)^2 + b$.

(-2,-16)

    (a) Find the values of a and b.
    (b) State the equation of the axis of symmetry.
    (c) Find the coordinates of P and Q.

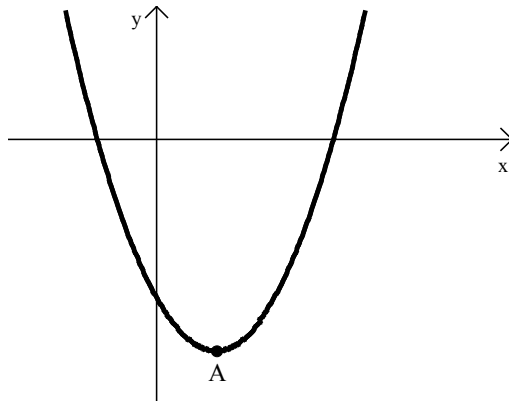17. The equation of the parabola in the diagram below is $y = (x - 4)^2 - 25$.
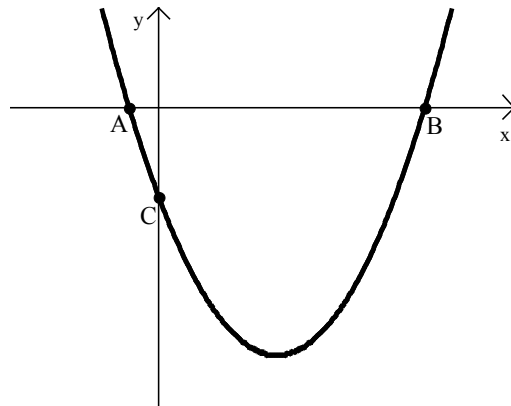
    (a) State the coordinates of the minimum turning point of the parabola.
    (b) Find the coordinates of C.
    (c) A is the point (-1,0). State the coordinates of B.

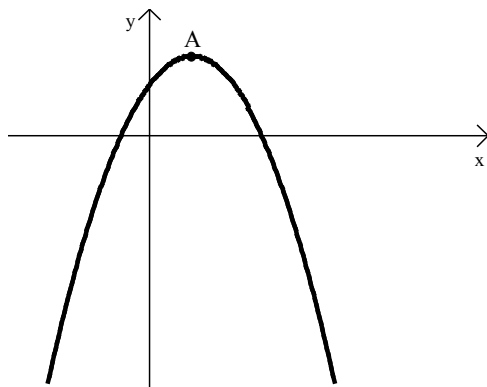18. The equation of the parabola below is $y = 16 - (x - 3)^2$.
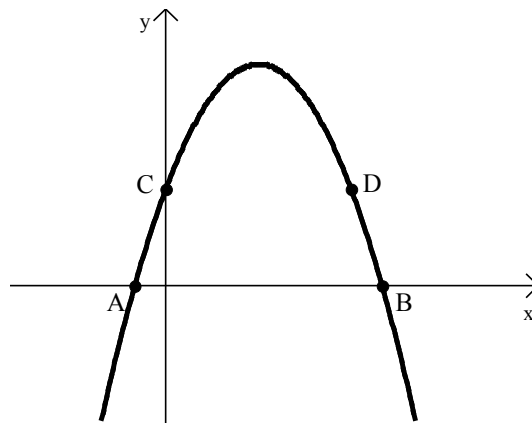
    (a) State the coordinates of the maximum turning point of the parabola.
    (b) Find the coordinates of A and B.
    (c) State the coordinates of C.
    (d) The point D has the same y-coordinate as C. State the coordinates of D.

19. (a) Factorise $x^2 - 4x - 12$
    (b) Write down the roots of the equation $x^2 - 4x - 12 = 0$.
    (c) The graph of $y = x^2 - 4x - 12$ is shown below.

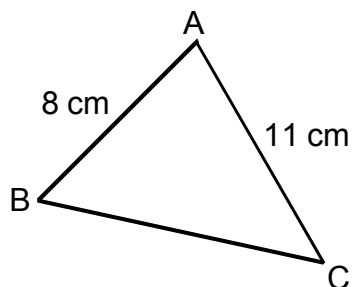Find the coordinates of the minimum turning point A.

20. (a) Solve the equation $4 + 3x - x^2 = 0$
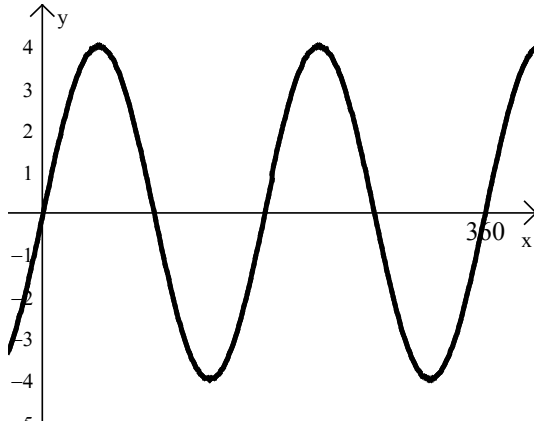   (b) The graph of $y = 4 + 3x - x^2$ is shown below.

Find the coordinates of A, the maximum turning point of the parabola.

21. Solve the following equations for $0 \leq x \leq 360$

    (a) $3\sin x° + 4 = 5$ (b) $4\cos x° + 1 = 0$ (c) $6 + 2\tan x° = 15$

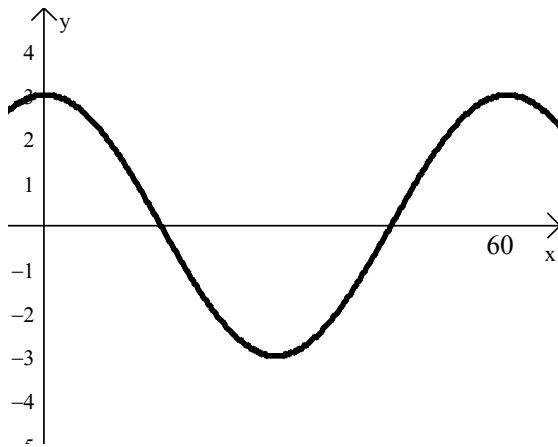   (d) $3\cos x° + \tan 40° = 0$ (e) $\sin 75° + 3\tan x° = -1$

22. Triangle ABC has area 35 cm².
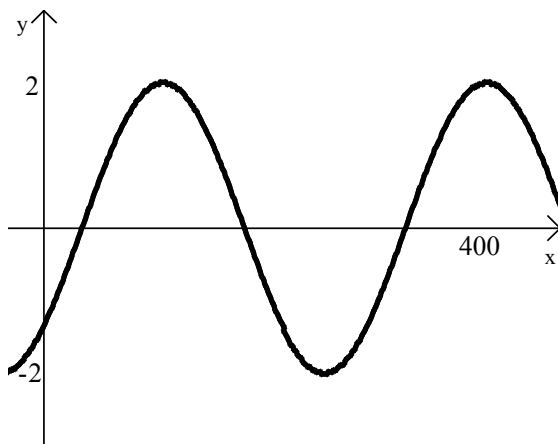   AB = 8 cm and AC = 11 cm,
    find **two** values for angle BAC.

23. The graph below has equation y = asin bx. State the values of a and b.

24. The graph below has equation y = acos bx. State the values of a and b.

25. The graph below has equation of the form y = acos(x – b). State the values of a and b.

26. Sketch the following graphs for $0 \leq x \leq 360$
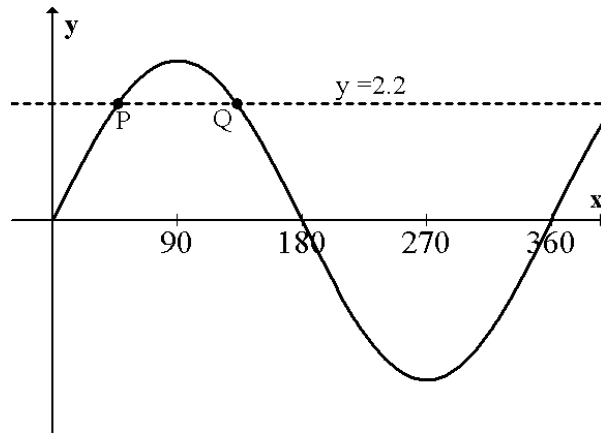
(a) $y = \sin 3x$ (b) $y = 2\cos 2x$ (c) $y = 4\sin(x - 20)$ (d) $y = 3\cos(x + 15)$

27. The diagram below shows the graph of y = 3sin x.

The line y = 2.2 has also been drawn on the graph.
Find the coordinates of P and Q.

28. The height of a fairground ride, in metres, is given by the formula

$$H = 6.8 + 3.2\sin (20t)°$$

where t is the time in seconds after the ride starts.

(a) What is the maximum height of the ride?
(b) What is the height of the ride before it starts?
(c) Find the height of the ride after 30 seconds.
(d) After how many seconds does the ride first reach a height of 5.2 metres?

29. The depth of water, D metres, in a harbour is given
   by the formula

$$D = 14 + 7\sin(15t)°.$$

where t is the number of hours after midnight.

(a) What is the maximum depth of water in the harbour?
(b) Calculate the depth of water in the harbour at 2.30pm.
(c) At what **two** times is the depth 10.5m?

30. A satellite is programmed to orbit the Earth. The height of
   the satellite above the Earth, in kilometres, is given by the
   formula
$$H = 120 + 25\sin(40t)^0$$

where t is the number of hours after midnight.

(a) What is the greatest distance from the Earth that the
   satellite will reach?
(b) Calculate the height of the satellite at 10.30 p.m.
(c) How many minutes after midnight will the satellite
   first be at a height of 132.5 kilometres?