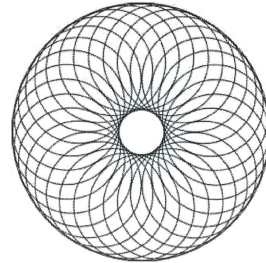


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# ⑥ Solving Quadratic Equations

① 2 solutions E/D  
 $x^2 = 1 \therefore x = \pm \sqrt{1}$   
 $x = \pm 1$

②  $(4x+3)(2x-1) = 0$   
 $\therefore x = -\frac{3}{4}$  or  $x = \frac{1}{2}$

③ Complete the square  
 $(x-2)^2 - 4 - 8 = 0$   
 $(x-2)^2 = 12$   
 $x-2 = \pm \sqrt{12}$   
 $x-2 = \pm 2\sqrt{3}$   
 $x = 2 \pm 2\sqrt{3}$

$p=2, q=2, r=3$   
 N.B. You can use the formula here!

①  $4x-1 = \pm \sqrt{25}$   
 $4x-1 = \pm 5$  C/B  
 $\swarrow \quad \searrow$   
 $4x-1 = 5 \quad 4x-1 = -5$   
 $4x = 6 \quad 4x = -4$   
 $x = \frac{3}{2} \quad x = -1$

② X through the equation by  $x$  such that:  
 $x^2 - 4x - 12 = 0$   
 $(x-6)(x+2) = 0$   
 $x = 6, x = -2$

③ Use the formula  
 $a = 4 \cdot 9, b = -1, c = -36$   
 $t = 2.81$  or  $t = -2.61$   
 $t = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(4 \cdot 9)(-36)}}{2(4 \cdot 9)}$

① X by  $\sqrt{x}$ :  $x-3 = 2\sqrt{x}$   
 $x - 2\sqrt{x} - 3 = 0$   
 $(\sqrt{x}-3)(\sqrt{x}+1) = 0$   
 $\swarrow \quad \searrow$   
 $\sqrt{x}-3 = 0 \quad \sqrt{x}+1 = 0$   
 $\sqrt{x} = 3 \quad \sqrt{x} = -1$   
 $x = 9$

② Area of Parallelogram  
 $(x+6)(13-x) =$   
 $13x - x^2 + 78 - 6x =$   
 $78 + 7x - x^2$

Area of Square:  
 $(x+1)(x+1) = x^2 + 2x + 1$   
 $\therefore 78 + 7x - x^2 - (x^2 + 2x + 1) = 74$   
 $-2x^2 + 5x + 77 = 74$   
 $2x^2 - 5x - 3 = 0$   
 $x = 3 \quad x \neq -\frac{1}{2}$   
 $\therefore \text{Area} = (3+1)^2 = 16$

③  $16x^2 = 8x - 1$   
 $16x^2 - 8x + 1 = 0$   
 $(4x-1)^2 = 0$   
 $\therefore x = \frac{1}{4}$

(Square both sides!)  
 $A/A \neq$

Year 1  
 Answers

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# ⑦ Completing the Square

①  $(x+3)^2 - 9 - 8$   
 $(x+3)^2 - 17$  E/D

②  $4[x^2 - 2x]$   
 $4[(x-1)^2 - 1]$   
 $4(x-1)^2 - 4$

③  $(x-5)^2 - 25 + 8 = 0$   
 $(x-5)^2 - 17 = 0$   
 $(x-5)^2 = 17$   
 $x-5 = \pm\sqrt{17}$   
 $x = 5 \pm \sqrt{17}$   
 $\therefore q = 17$

①  $(x-\frac{5}{2})^2 - \frac{25}{4} + 1$  C/B  
 $(x-\frac{5}{2})^2 - \frac{25}{4} + \frac{4}{4}$   
 $(x-\frac{5}{2})^2 - \frac{21}{4}$

②  $-5[x^2 - 2x] + 7$   
 $-5[(x-1)^2 - 1] + 7$   
 $-5(x-1)^2 + 5 + 7$   
 $-5(x-1)^2 + 12$

$p = -5, r = -1, q = 12$

③  $(x-\frac{9}{2})^2 - \frac{81}{4} + 30 = 0$   
 $(x-\frac{9}{2})^2 \neq \frac{-39}{4}$

Can't root - number for real solutions.  
 N.B You can use the discriminant if you know it too!  
 $b^2 - 4ac < 0$  for  $x^2 - 9x + 30$

①  $2[x^2 - 2px] + 1 = 0$   
 $2[(x-p)^2 - p^2] + 1 = 0$   
 $2(x-p)^2 - 2p^2 + 1 = 0$   
 $(x-p)^2 = \frac{2p^2 - 1}{2}$

$x-p = \pm \sqrt{\frac{2p^2 - 1}{2}}$   
 $x = p \pm \sqrt{\frac{2p^2 - 1}{2}}$   
 o.e.

A few approaches

②  $-[x^2 + 3x] + 8$   
 $-[(x+\frac{3}{2})^2 - \frac{9}{4}] + 8$   
 $-(x+\frac{3}{2})^2 + \frac{9}{4} + 8$   
 $-(x+\frac{3}{2})^2 + \frac{41}{4}$

$\therefore \frac{41}{4}$

③  $(2x-3)^2 = k-8$   
 $2x-3 = \pm\sqrt{k-8}$

$k-8 > 0$  as you can't take the square root of a negative number to get a real solution.

If  $k=8$  then there is one solution.  
 For 2 solutions  $k-8 > 0$

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# ⑧ Function Notation

①  $f(1.5) = 3 - (1.5)^2$   
 $= \frac{3}{4}$

②  $\frac{16}{a^2} = 4$  ← just sub in  $x=a$  and solve

$\frac{16}{4} = a^2$

$4 = a^2$

$\pm 2 = a$

$\therefore a = 2$

E/D

③ Set them equal and solve:

$x^2 - 7 = 3x + 3$

$x^2 - 3x - 10 = 0$

$(x-5)(x+2) = 0$

$x = 5$  or  $x = -2$

$\therefore \underline{x = 5}$

① roots, just solve the equation  $= 0$ .

$x(x^2 - 4) = 0$

$x(x+2)(x-2) = 0$

$\therefore x = 0, x = -2, x = 2$

② Complete the square

$(x+6)^2 - 36$

$\therefore \text{min} = 36$  C/B

@  $x = -6$

③ Set them equal

$x^3 - 7 = x(x+1)(x-2)$

$x^3 - 7 = x(x^2 - x - 2)$

$x^3 - 7 = x^3 - x^2 - 2x$

$0 = -x^2 - 2x + 7$

$0 = x^2 + 2x - 7$

$0 = (x+1)^2 - 1 - 7$

$8 = (x+1)^2$

$\pm 2\sqrt{2} = x+1$

$x = -1 \pm 2\sqrt{2}$

N.B: You can use the equation here! instead of completing the square.

Roots in ascending order.

$-\sqrt{3}, -1, \sqrt{3}$ .

①  $a^{-3/2} + 1 = 28$

$a^{-3/2} = 27$

$a = 27^{-2/3}$

$a = \left(\frac{1}{27}\right)^{2/3}$

$a = \frac{1}{9}$

A/A\*

②  $(x^2 + 8)(x^2 - 1) = 0$

$x^2 + 8 \neq 0$  for real solutions

$\therefore x^2 - 1 = 0$

$x^2 = 1$

$x = \pm 1$

③  $(x+1)^2 = 0$

$\therefore x = -1$

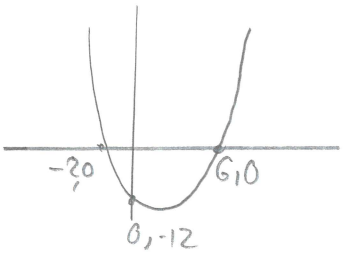
$x^2 - 3 = 0$

$x^2 = 3$

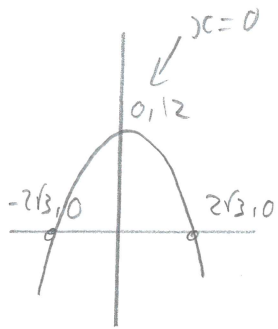
$\therefore x = \pm\sqrt{3}$

# ⑨ Quadratic Graphs

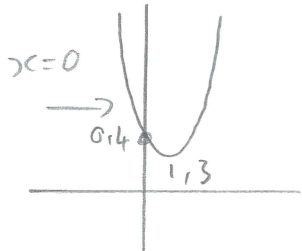
① when  $x=0$ ,  $y=-12$   
 when  $y=0$ ,  $0=(x-6)(x+2)$   
 $\therefore x=6$  or  $x=-2$



②  $0 = -x^2 + 12$   
 $x^2 = 12$   
 $x = \pm\sqrt{12}$   
 $x = \pm 2\sqrt{3}$

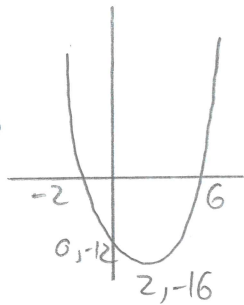


③  $y = (x-1)^2 - 1 + 4$   
 $y = (x-1)^2 + 3$



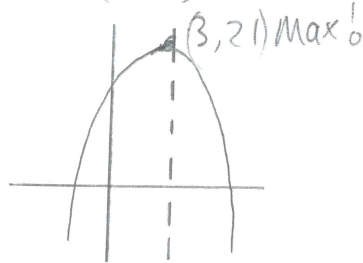
E/D

①  $y = (x-2)^2 - 4 - 12$   
 $y = (x-2)^2 - 16$



Same as Q① before  
 but complete the square for min point

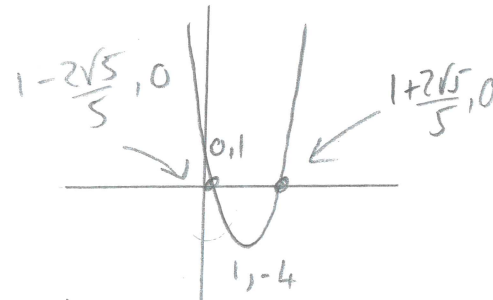
②  $y = -[x^2 - 6x] + 12$   
 $-[(x-3)^2 - 9] + 12$   
 $-(x-3)^2 + 9 + 12$   
 $-(x-3)^2 + 21$



$x=3$  is the axis of symmetry

(3, 21) is a maximum

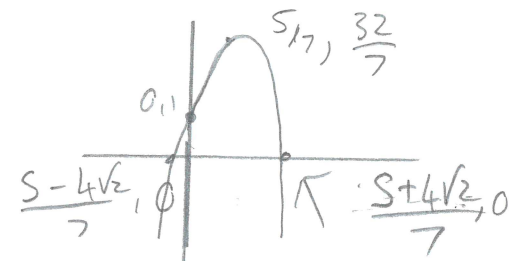
③  $y = 5[x^2 - 2x] + 1$   
 $y = 5[(x-1)^2 - 1] + 1$   
 $y = 5(x-1)^2 - 4$



Roots are when  $y=0$ .  
 Solve using equation.

①  $c=1$   $\therefore y = 2x^2 + 6x + 1$   
 sub in  $(-2, -7)$   
 $-7 = 2(4) + 6(-2) + 1$   
 $-7 = -2b + 9$   
 $-16 = -2b$   
 $\therefore b = +8 \Rightarrow y = 2x^2 + 8x + 1$   
 roots are  $x = \frac{-4 \pm \sqrt{14}}{2}$

②  $y = -7[x^2 - \frac{10}{7}x] + 1$   
 $y = -7[(x - \frac{5}{7})^2 - \frac{25}{49}] + 1$   
 $y = -7(x - \frac{5}{7})^2 + \frac{25}{7} + 1$   
 $y = -7(x - \frac{5}{7})^2 + \frac{32}{7}$



Find the roots by solving the quadratic:  
 $x = \frac{5 \pm 4\sqrt{2}}{7}$

③ You can do this with the discriminant too!

$$y = (x + \frac{p}{2})^2 - \frac{p^2}{4} + q$$

$$-\frac{p^2}{4} + q > 0$$

$$q > \frac{p^2}{4}$$

$$4q > p^2$$

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# ⑩ The Discriminant

① No real roots

②  $a=1, b=6, c=5$

$$b^2 - 4ac$$

$$36 - 4(1)(5) = 16$$

$\therefore > 0$  and 2 real roots



① Repeated root  $\therefore$

$$b^2 - 4ac = 0$$

$$a=1, b=k, c=16$$

$$k^2 - 4(1)(16) = 0$$

$$k^2 - 64 = 0$$

$$k = \pm\sqrt{64}$$

$$k = \pm 8$$

②  $a=6, b=4k, c=5$

$$(16k^2) - 4(6)(5) = -56$$

$$16k^2 = 64$$

$$k^2 = 4$$

$$k = \pm\sqrt{4}$$

$$k = \pm 2$$

$$\therefore k = -2$$

③  $b^2 - 4ac < 0$  for no real roots

$$a=k, b=5k, c=-3$$

$$25k^2 - 4(k)(-3) < 0$$

$$25k^2 + 12k < 0$$

$$k(25k + 12) < 0$$

$$k \neq 0 \therefore k < -\frac{12}{25}$$

①  $y=3$  and  $y=x^2+kx+10$

$$\therefore x^2+kx+10=3$$

$$x^2+kx+7=0$$

If they don't intersect

$$b^2 - 4ac < 0$$

$a=1, b=k, c=7$

$$k^2 - 4(1)(7) < 0$$

$$k^2 - 28 < 0$$

$$(k + \sqrt{28})(k - \sqrt{28}) < 0$$

$$(k + 2\sqrt{7})(k - 2\sqrt{7}) < 0$$

$$\therefore -2\sqrt{7} < k < 2\sqrt{7}$$

②  $b^2 - 4ac = 0$  for repeated root

$$a=4k, b=4k, c=4$$

$$(4k)^2 - 4(4k)(4) = 0$$

$$16k^2 - 64k = 0$$

$$k^2 - 4k = 0$$

$$k(k-4) = 0$$

$$k \neq 0, k = 4 \checkmark$$

③ Sub in points:

$$(0, -1) \therefore q = -1$$

$$y = x^2 + px - 1$$

$$(3, -10)$$

$$-10 = 9 + 3p - 1$$

$$p = -6$$

$$\therefore y = x^2 - 6x - 1$$

$$a=1, b=-6, c=-1$$

$$b^2 - 4ac$$

$$(-6)^2 - 4(1)(-1)$$

$$= 36 + 4$$

$$= 40$$

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