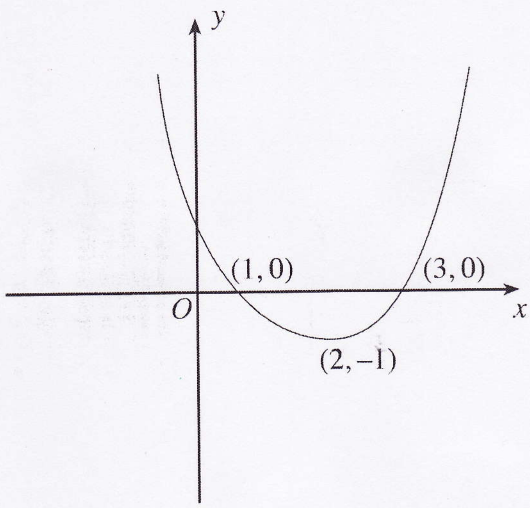
C1 January Test – Practise Paper (Non-Calculator)

1. Simplify the following.

(a) $\sqrt{20} + \dfrac{\sqrt{35}}{\sqrt{7}} - \dfrac{20}{\sqrt{5}}$ [4]

(b) $\dfrac{2+\sqrt{3}}{5+2\sqrt{3}}$ [4]

2. The diagram shows the graph of $y = f(x)$. The graph has a minimum point at $(2, -1)$ and intersects the x-axis at the points $(1, 0)$ and $(3, 0)$.



Sketch the following graphs, using a separate set of axes for each graph. In each case you should indicate the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x-axis.

(a) $y = 3f(x)$ (b) $y = f(x+5)$ [3], [3]

3. Show that $x^2 + 1{\cdot}8x - 3{\cdot}19$ may be expressed in the form $(x+p)^2 - 4$, where p is a constant whose value is to be found.
Hence solve the quadratic equation $x^2 + 1{\cdot}8x - 3{\cdot}19 = 0$. [5]

4. (a) Find the range of values of k for which the quadratic equation

$$3x^2 + 2x - k = 0$$

has two distinct real roots. [4]

(b) Solve the inequality $x^2 - 5x - 14 \leqslant 0$. [3]

5. The points A, B, C have coordinates $(-2, 3)$, $(10, -1)$, $(3, 8)$ respectively. The line through C perpendicular to AB intersects AB at the point D.

(a) Find the gradient of AB. [2]

(b) Show that AB has equation

$$x + 3y - 7 = 0$$

and find the equation of CD. [5]

(c) Show that D has coordinates $(1, 2)$. [2]

(d) The mid-point of AB is denoted by E. Find the length of ED. [4]

C1 January Test – Practise Paper (Solutions)

1 (a) $\sqrt{20} + \dfrac{\sqrt{35}}{\sqrt{7}} - \dfrac{20}{\sqrt{5}}$

$= \sqrt{4\times5} + \sqrt{\dfrac{35}{7}} - \dfrac{20}{\sqrt{5}}\times\dfrac{\sqrt{5}}{\sqrt{5}}$

$= 2\sqrt{5} + \sqrt{5} - \dfrac{20\sqrt{5}}{5}$

$= 3\sqrt{5} - 4\sqrt{5}$

$= -\sqrt{5}$

(b) $\dfrac{(2+\sqrt{3})}{(5+2\sqrt{3})} \times \dfrac{(5-2\sqrt{3})}{(5-2\sqrt{3})}$ ⇐ "Rationalise the Denominator"

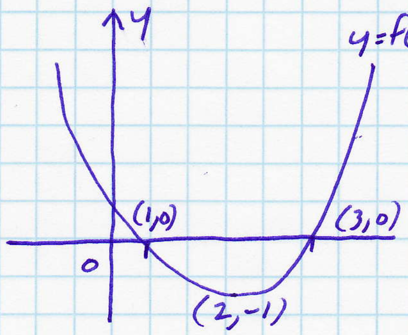
$= \dfrac{10 - 4\sqrt{3} + 5\sqrt{3} - 6}{25 - 10\sqrt{3} + 10\sqrt{3} - 12}$

$\sqrt{3}\times-2\sqrt{3} = -2\sqrt{3\times3} = -2\sqrt{9} = -2\times3 = -6$

$2\sqrt{3}\times-2\sqrt{3} = -4\sqrt{3\times3} = -4\sqrt{9} = -4\times3 = -12$

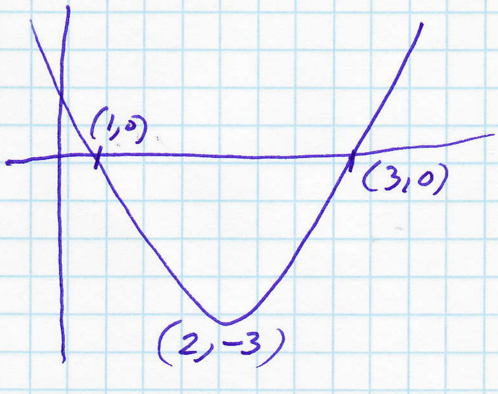
$= \dfrac{4+\sqrt{3}}{13}$

2 (a)

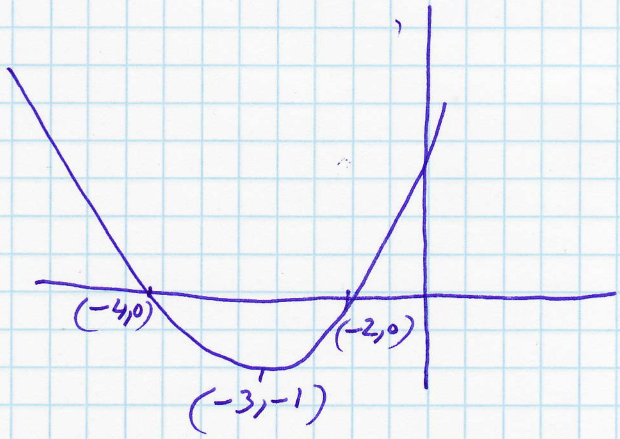


$\Rightarrow$

$y = 3f(x)$ take y coords and ×3



(b) $y = f(x+5)$ translates $f(x)$ $\begin{bmatrix}-5\\0\end{bmatrix}$



③ $x^2 + 1.8x - 3.19$

$(x+0.9)^2 + P \longrightarrow$

$0.9 \times 0.9 = 0.81$

$0.81 + P = -3.19$

$P = -3.19 - 0.81$

$P = -4$

$(x+0.9)^2 - 4$

Now $(x+0.9)^2 - 4 = 0$

$(x+0.9)^2 = 4$

$(x+0.9) = \pm 2$

$x = -0.9 \pm 2$

$\therefore$ either $x = -0.9 + 2 = 1.1$

or $x = -0.9 - 2 = -2.9$

④ (a) $3x^2 + 2x - k = 0$

two distinct roots $\therefore$ $b^2 - 4ac > 0$

$2^2 - 4 \times 3 \times -k > 0$

$4 + 12k > 0$

$12k > -4$

$k > -\frac{4}{12}$

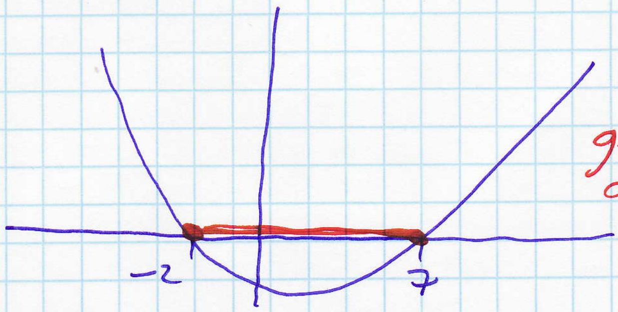
$k > -\frac{1}{3}$

(b) $x^2 - 5x - 14 \leq 0$

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

$\therefore$ cross axis $x = 7$
$x = -2$

+ve x^2 $\therefore$ V



graph below axis between these points ie ≤ 0

$\therefore$ $-2 \leq x \leq 7$

(5) $A(-2,3)$ $B(10,-1)$ $C(3,8)$ $D(?,?)$

(a) gradient $AB = \frac{-1-3}{10--2} = \frac{-4}{12} = \frac{-1}{3}$

(b) equation $\frac{y-3}{-1-3} = \frac{x--2}{10--2}$

$$\frac{y-3}{-4} = \frac{x+2}{12}$$

$$12(y-3) = -4(x+2)$$

$$12y-36 = -4x-8$$

$$4x+12y-28=0$$

$\div 4$ $x+3y-7=0$ As required

Now CD is perpendicular to AB $\therefore M_{CD} = +3$

equation of line with gradient $+3$, passing through $C(3,8)$

$$y-8 = 3(x-3)$$

$$y-8 = 3x-9$$

$$y = 3x-1$$

(c) The two lines intersect at D so solving their equations simultaneously will give the co-ordinates of D:

$x+3y-7=0$ — (1)

$y = 3x-1$ — (2)

Subst (2) in (1) for y

$$x+3(3x-1)-7=0$$

$$x+9x-3-7=0$$

$$10x-10=0$$

$$x=1$$

in (2) $y = 3(1)-1 = 3-1 = 2$

$\therefore$ Coords of D $(1,2)$

As required

(5) (d) E = Midpoint of AB $= \left(\frac{-2+10}{2}, \frac{3+-1}{2}\right) = (4,1)$

$E(4,1) \quad D(1,2)$

Length ED $= \sqrt{(4-1)^2+(1-2)^2}$

$= \sqrt{3^2+(-1)^2}$

$= \sqrt{9+1}$

$= \sqrt{10}$