Leave blank

8. The equation

$$x^2 + kx + 8 = k$$

has no real solutions for x.

(a) Show that k satisfies $k^2 + 4k - 32 < 0$.

(3)

(b) Hence find the set of possible values of k.

(4)

a) no real solutions $\Rightarrow$ $b^2 - 4ac < 0$

$x^2 + kx + 8 - k = 0$

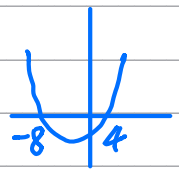
$k^2 - 4 \times 1 \times (8-k) < 0$

$k^2 - 32 + 4k < 0$

$k^2 + 4k - 32 < 0$

b)

$(k-4)(k+8) < 0$



$-8 < k < 4$

N 2 5 5 6 1 A 0 1 2 2 4

Leave blank

8. Given that the equation $2qx^2 + qx - 1 = 0$, where q is a constant, has no real roots,

(a) show that $q^2 + 8q < 0$.

(2)

(b) Hence find the set of possible values of q.

(3)

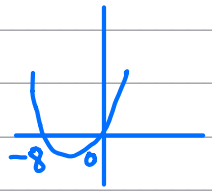
a) no real roots $\Rightarrow b^2 - 4ac < 0$

$2qx^2 + qx - 1 = 0$

$q^2 - 4 \times 2q \times (-1) < 0$

$q^2 + 8q < 0$

b) $q(q+8) < 0$



$-8 < q < 0$

H 2 9 9 9 2 A 0 1 6 2 8

Leave blank

7. The equation $kx^2 + 4x + (5 - k) = 0$, where k is a constant, has 2 different real solutions for x.

(a) Show that k satisfies

$$k^2 - 5k + 4 > 0.$$

(3)

(b) Hence find the set of possible values of k.

(4)

a) 2 real solutions $\Rightarrow$ $b^2 - 4ac > 0$

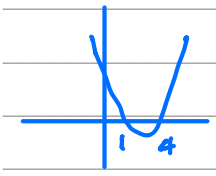
$kx^2 + 4x + (5-k) = 0$

$4^2 - 4k(5-k) > 0$

$16 - 20k + 4k^2 > 0$

$k^2 - 5k + 4 > 0$

b) $(k-1)(k-4) > 0$



Either $k < 1$ or $k > 4$

N 3 0 0 8 1 A 0 1 2 2 8

Leave blank

6. The equation $x^2 + 3px + p = 0$, where p is a non-zero constant, has equal roots.

Find the value of p.

(4)

Equal roots $\Rightarrow b^2 - 4ac = 0$

$x^2 + 3px + p = 0$

$(3p)^2 - 4 \times 1 \times p = 0$

$9p^2 - 4p = 0$

$p(9p - 4) = 0$

$\Rightarrow p = 0$ or $p = \frac{4}{9}$

Given $p \neq 0$ $\therefore p = \frac{4}{9}$

H 3 4 2 6 2 A 0 1 0 2 8

Leave blank

10. $f(x) = x^2 + 4kx + (3 + 11k)$, where k is a constant.

(a) Express $f(x)$ in the form $(x + p)^2 + q$, where p and q are constants to be found in terms of k.

(3)

Given that the equation $f(x) = 0$ has no real roots,

(b) find the set of possible values of k.

(4)

Given that $k = 1$,

(c) sketch the graph of $y = f(x)$, showing the coordinates of any point at which the graph crosses a coordinate axis.

(3)

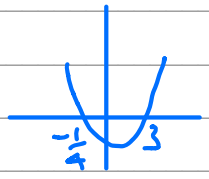
a) $f(x) = (x+2k)^2 + (3 + 11k - 4k^2)$

$p = 2k$, $q = 3 + 11k - 4k^2$

b) no real roots $\Rightarrow 3 + 11k - 4k^2 > 0$

$\Rightarrow 4k^2 - 11k - 3 < 0$

$(4k+1)(k-3) < 0$

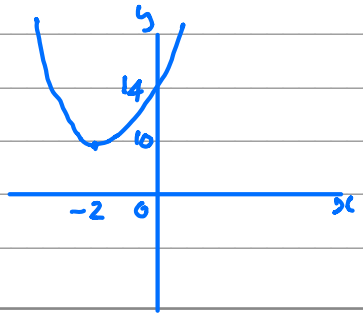


$-\frac{1}{4} < k < 3$

c) $k = 1$ $f(x) = (x+2)^2 + (3 + 11 - 4)$

$f(x) = (x+2)^2 + 10$

Minimum point $(-2, 10)$



N 3 4 8 5 4 A 0 2 4 2 8

Leave blank

4. (a) Show that $x^2 + 6x + 11$ can be written as

$$(x + p)^2 + q$$

where p and q are integers to be found.

(2)

(b) In the space at the top of page 7, sketch the curve with equation $y = x^2 + 6x + 11$, showing clearly any intersections with the coordinate axes.

(2)

(c) Find the value of the discriminant of $x^2 + 6x + 11$

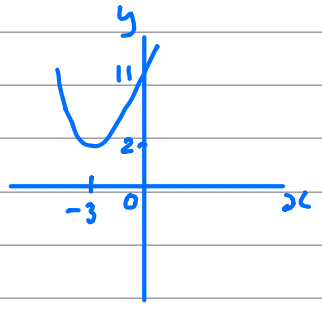
(2)

a) $x^2 + 6x + 11 = (x+3)^2 + 11 - 9$

$= (x+3)^2 + 2$

$p = 3, \quad q = 2$

b)



Minimum point $(-3, 2)$

c) $x^2 + 6x + 11$

Discriminant $= b^2 - 4ac$

$= 6^2 - 4 \times 1 \times 11$

$= 36 - 44$

$= -8$

H 3 5 3 8 3 A 0 6 2 8