Topic assessment

1. Solve the following sets of simultaneous equations.

   (i) $2x+3y=-7$
   $5x-2y=11$ [4]

   (ii) $3x-2y=3$
   $y=1-2x$ [4]

   (iii) $x+2y=13$
   $x^2-y^2=9$ [6]

2. Solve the following inequalities.

   (i) $2x+3<1-x$ [2]

   (ii) $3(y-1)\geq 5y-8$ [3]

3. Solve the following inequalities.

   (i) $x^2+2x-15\leq 0$ [3]

   (ii) $2p^2-7p+3>0$ [3]

   (iii) $z(2-z)<z-12$ [4]

4. Find the points of intersection of the curves $y=x^2-5x+4$ and $y=2-x^2$.
   Sketch both these curves on one diagram and label the points of intersection.
   Show by shading the region for which both $y<x^2-5x+4$ and $y<2-x^2$.
   [6]

5. The quadratic equation $x^2+(3k+1)x-k=0$ has no real roots.
   Find the possible set of values for k. [5]

Total 40 marks

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Solutions to topic assessment

1. (i) $2x+3y=-7$ (1) $\times 2$ $\quad 4x+6y=-14$

$5x-2y=11$ (2) $\times 3$ $\quad 15x-6y=33$

Adding: $\quad 19x = 19$

$x=1$

Substituting $x=1$ into (1): $2+3y=-7$

$3y=-9$

$y=-3$

The solution is $x=1$, $y=-3$. Check: $2x+3y=2-9=-7$

$5x-2y=5+6=11$

[4]

(ii) $3x-2y=3$ (1)

$y=1-2x$ (2)

Substitute (2) into (1): $3x-2(1-2x)=3$

$3x-2+4x=3$

$7x=5$

$x=\frac{5}{7}$

Substituting $x=\frac{5}{7}$ into (2): $y=1-2\times\frac{5}{7}=1-\frac{10}{7}=-\frac{3}{7}$

The solution is $x=\frac{5}{7}$, $y=-\frac{3}{7}$. Check: $3x-2y=\frac{15}{7}-\frac{-6}{7}=\frac{21}{7}=3$

[4]

(iii) $x+2y=13$ (1)

$x^2-y^2=9$ (2)

(1) $\Rightarrow x=13-2y$

Substituting into (2): $(13-2y)^2-y^2=9$

$169-52y+4y^2-y^2=9$

$3y^2-52y+160=0$

$(y-4)(3y-40)=0$

$y=4$ or $y=\frac{40}{3}$

When $y=4$, $x=13-8=5$

When $y=\frac{40}{3}$, $x=13-\frac{80}{3}=-\frac{41}{3}$

The solutions are $x=5$, $y=4$ and $x=-\frac{41}{3}$, $y=\frac{40}{3}$.

[6]

2. (i) $2x+3<1-x$

$3x<-2$

$x<-\frac{2}{3}$

[2]

(ii) $3(y-1) \geq 5y-8$

$3y-3 \geq 5y-8$

$5 \geq 2y$

$2y \leq 5$

$y \leq \frac{5}{2}$

[3]

3. (i) $x^2+2x-15 \leq 0$

$(x+5)(x-3) \leq 0$

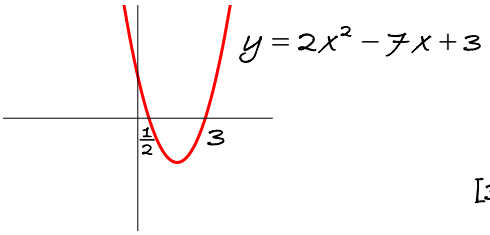
From graph, $-5 \leq x \leq 3$

[3]

(ii) $2p^2-7p+3>0$

$(2p-1)(p-3)>0$

From graph, $p<\frac{1}{2}$ or $p>3$.



[3]

(iii) $z(2-z)<z-12$

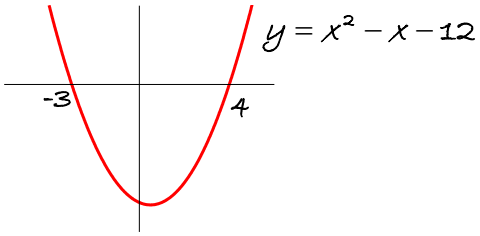
$2z-z^2<z-12$

$0<z^2-z-12$

$z^2-z-12>0$

$(z-4)(z+3)>0$

From graph, $z<-3$ or $z>4$.



[4]

4. At points of intersection, $x^2-5x+4=2-x^2$

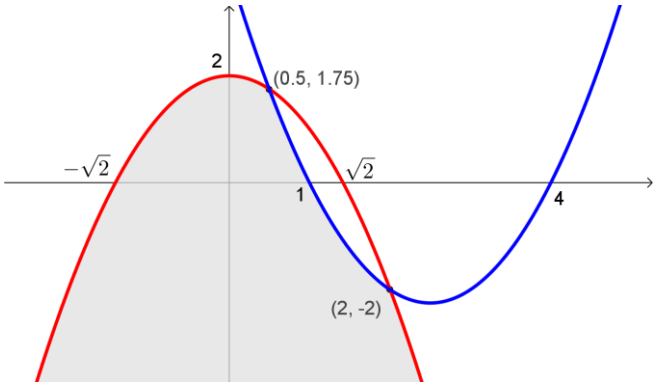
$2x^2-5x+2=0$

$(2x-1)(x-2)=0$

$x=\frac{1}{2}$ or 2

When $x=\frac{1}{2}$, $y=2-\frac{1}{4}=\frac{7}{4}$

When $x=2$, $y=2-4=-2$



[6]

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5. $x^2 + (3k+1)x - k = 0$

$a = 1, b = 3k+1, c = -k$

If the equation has no real roots:

$b^2 - 4ac < 0$

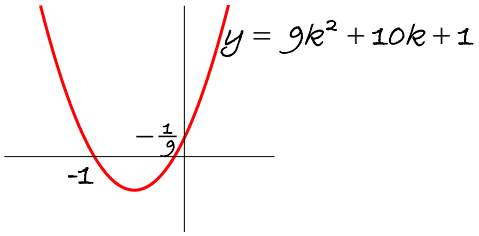
$(3k+1)^2 - 4 \times 1 \times -k < 0$

$9k^2 + 6k + 1 + 4k < 0$

$9k^2 + 10k + 1 < 0$

$(9k+1)(k+1) < 0$

From graph, $-1 < k < -\frac{1}{9}$



[5]