GRADE 11

MATHEMATICS INVESTIGATION

MARKING GUIDES

MARKS: 55

SECTION A

Part 1:

1.	$12x^2+5x-2=0$ $x=\frac{-5\pm\sqrt{5^2-4(12)(-2)}}{24}$ $x=\frac{-5\pm\sqrt{25+96}}{24}$ $x=\frac{-5+\sqrt{121}}{24}$ *or* $x=\frac{-5-\sqrt{121}}{24}$ $x=\frac{1}{4}$ *or* $x=-\frac{2}{3}$ Not equal Real Irrational	✓ correct substitution ✓✓ answers ✓ Not equal ✓ Real ✓ Irrational (6)

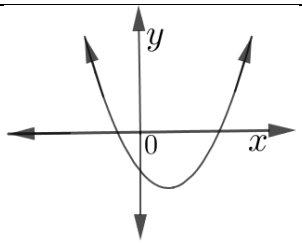
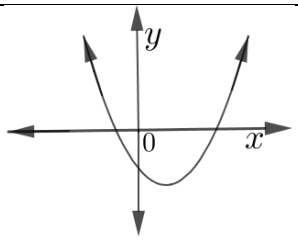
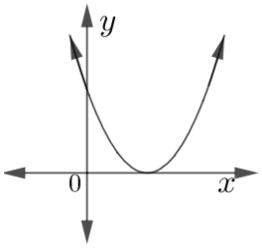
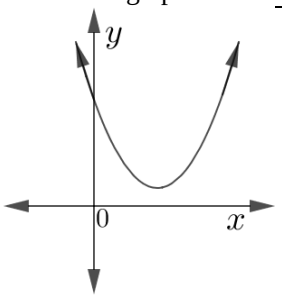
2.	$3x^2+6x+1=0$ $x=\frac{-6\pm\sqrt{6^2-4(3)(1)}}{6}$ $x=\frac{-6\pm\sqrt{24}}{6}$ $x=\frac{-6+\sqrt{24}}{6}$ *or* $x=\frac{-6-\sqrt{24}}{6}$ $x=-0,18$ *or* $x=-1,82$ Not equal Real Irrational		✓ correct substitution ✓ $x=-0,18$ ✓ $x=-1,82$ ✓ Not equal ✓ Real ✓ Irrational (6)
3.	$x^2-6x+9=0$ $x=\frac{6\pm\sqrt{(-6)^2-4(1)(9)}}{2}$ $x=\frac{6\pm\sqrt{0}}{2}$ $x=3$ *or* $x=3$ Real, Equal, Rational		✓ correct substitution ✓✓ both answers ✓ Equal ✓ Real ✓ Rational (6)
4.	$2x^2+4x+10=0$ $x=\frac{-4\pm\sqrt{4^2-4(2)(10)}}{4}$ $x=\frac{-4\pm\sqrt{16-80}}{4}$ $x=\frac{-4\pm\sqrt{-64}}{4}$ *No roots* $x\notin R$		✓ correct substitution ✓ $\sqrt{-64}$ ✓ No solution ✓ N/A ✓ N/A ✓ Non – real (6)
	Part 2		
1.	**Equation**	$\Delta=b^2-4ac$	

a.	$12x^2 + 5x - 2 = 0$	$12x^2+5x-2=0$ $\Delta = b^2-4ac$ $= 5^2 - 4(12)(-2)$ $= 121$	✓ $\Delta = 121$ (1)
b.	$3x^2 + 6x + 1 = 0$	$3x^2+6x+1=0$ $\Delta = b^2-4ac$ $= (6)^2 - 4(3)(1)$ $= 24$	✓ $\Delta = 24$ (1)
c.	$x^2 - 6x + 9 = 0$	$x^2-6x+9=0$ $\Delta = b^2-4ac$ $= (-6)^2 - 4(1)(9)$ $= 0$	✓ $\Delta = 0$ (1)
d.	$2x^2 + 4x + 10 = 0$	$2x^2+4x+10=0$ $\Delta = b^2-4ac$ $= 4^2 - 4(2)(10)$ $= -64$	✓ $\Delta = -64$ (1)

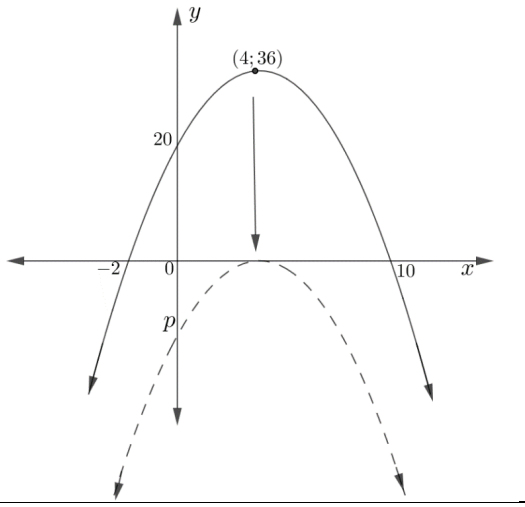
2.

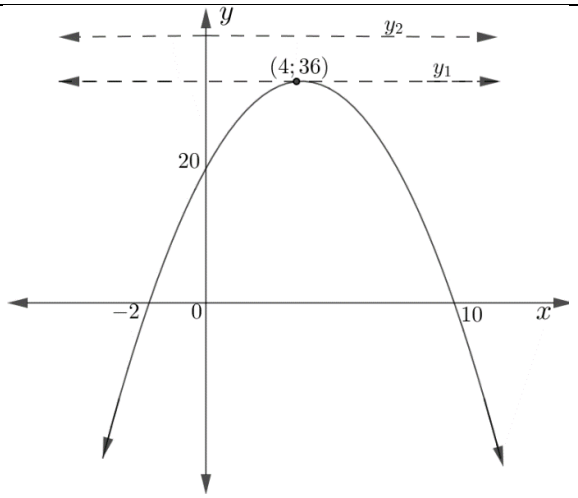
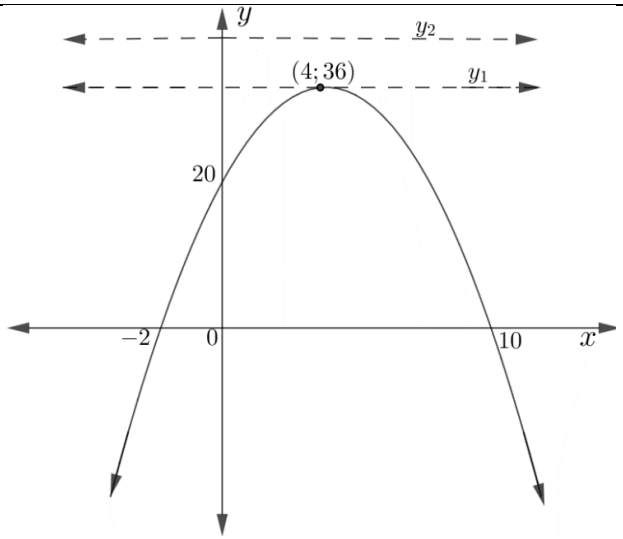
	Discriminant	Roots are: Equal/ unequal	Roots are: Rational/ irrational	Roots are: Real / Non - real	
$\Delta > 0$ and a perfectsquare	121	Unequal	Rational	Real	✓
$\Delta > 0$ and is not a perfectsquare	24	Unequal	Irrational	Real	✓
$\Delta = 0$	0	Equal	Rational	Real	✓
$\Delta < 0$	-64	N/A	N / A	Non - real	✓
					1x4= 4

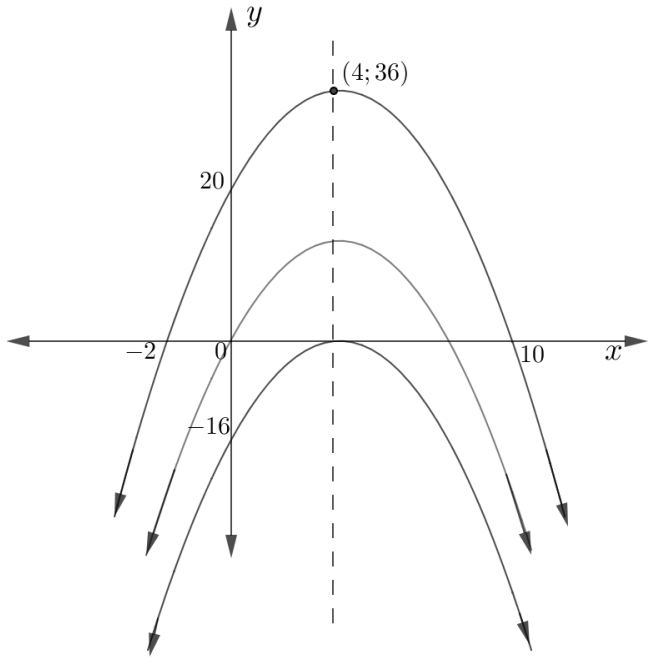
Part 3

Function	**Nature of the roots (from part 2 above)**	**Rough sketch**
$y = 12x^2 + 5x - 2$	$\Delta > 0$	
The graph has two *x*-intercepts		✓✓ graph
$y = 3x^2 + 6x + 1$	$\Delta > 0$	
The graph has two *x*-intercepts		✓✓graph
$y = x^2 - 6x + 9$	$\Delta = 0$	
The graph has one *x*-intercepts		✓✓graph
$y = 2x^2 + 4x + 10$	$\Delta < 0$	
The graph has no *x*-intercepts		✓✓graph

SECTION B

1.	$x^2+(1-k)x+k-3=0$ $\Delta=b^2-4ac$ $\Delta=(1-k)^2-4(1)(k-3)$ $\Delta=1-2k+k^2-4k+12$ $\Delta=k^2-6k+13$ $\Delta=k^2-6k+(-3)^2-(-3)^2+13$ $\Delta=(k-3)^2+4$ Now: $(k-3)^2\geq 0$ $\therefore (k-3)^2+4\geq 4$ $\therefore \Delta>0$ $\therefore$ roots are real	✓ Substitution ✓ $\Delta=k^2-6k+13$ ✓ $(k-3)^2$ ✓+4 ✓ $(k-3)^2\geq 0$ ✓ Conclusion (6)
2.1	Points of intersection: $4x+k=-x^2+8x+20$ $x^2-4x+k-20=0$ $\Delta=b^2-4ac$ $=(-4)^2-4(1)(k-20)$ $=16-4k+80$ $=96-4k$ For the tangent there is one point of intersection Thus $\Delta=0$ i.e. equal roots $96-4k=0$ $4k=96$ $k=24$	✓ $4x+k=-x^2+8x+20$ ✓ $x^2-4x+k-20=0$ standard form ✓ $(-4)^2-4(1)(k-20)$ substitution ✓ $96-4k$ simplify ✓ $\Delta=0$ ✓ $k=24$ answer (6)
2.2.1		✓ $p=-16$ answer (2)

	$p = 20 - 36$ $p = -16$ OR	
	 $-x^2 + 8x + p = 0$ $-x^2 + 8x + 20 = 20 - p$ Thus the horizontal line $y_1 = 20 - p$ will intersect f at the turning point.(it is a tangent to f at turning point) $20 - p = 36$ $p = -16$	✓ $p = -16$
2.2.2	 The horizontal line $y_2 = b$ will not intersect f $\therefore \quad b > 36$	✓ $b > 36$ answer (1)
2.2.3		✓ $-16 \leq x < 0$ answer



$-16 \leq x < 0$