Question 1 (7 marks)

(a) Part of the graph of  is shown below.



 Determine the values of the coefficients a and b. (3 marks)

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| **Solution** |
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| **Specific behaviours** |
| ✓ uses roots to express in factored form✓ uses y-intercept to find a✓ expands and states b |

(b) A quadratic has equation . Determine

(i) the coordinates of its turning point. (2 marks)

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| **Solution** |
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| **Specific behaviours** |
| ✓ completes square, or uses x=-b/2a✓ states coordinates |

(ii) the exact values of the zeros of the quadratic. (2 marks)

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| **Solution** |
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| **Specific behaviours** |
| ✓ uses quadratic formula or completes square✓ states both roots in exact form |

(c) Is it possible to bend a 12 cm length of wire to form the perpendicular sides of a right angled triangle with area 20cm? (4 marks)

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| **Solution** |
| Height = *x* , Base = *12-x**Area:* $20$$=\frac{1}{2}x(12-x)$$$40=\frac{1}{2}x\left(12-x\right)$$$$12x-x^{2}-40=0$$$$x^{2}-12x+40=0$$*Discriminant =* $\left(-12\right)^{2}-4\left(1\right)\left(40\right)$$= -16 which is <0$*There are no real solutions, indicating this situation is impossible.* |
| **Specific behaviours** |
| ✓ Use of $x$ and $12-x$ correctly.✓ Substituting into area of a triangle formula✓ Correct general formula✓ Use of discriminant to indicate no real solutions.Note: 1 mark if they indicate that they would need two numbers which add to 12 and multiply to 40, 1 mark if they try some values to show that it is not possible, 1 mark if they set out a table in an orderly manner and reach the maximum of 6x6 giving 36 (ie max area is 18sq m)  and 1 mark for demonstrating that this is the maximum by extending the table etc. Basically use your professional judgement and (generously) allocate a mark out of 4 accordingly. |

Question 2 (8 marks)

(a) A circle of radius 5 has its centre at (6, -4).

(i) Determine the equation of this circle. (2 marks)

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| **Solution** |
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| **Specific behaviours** |
| ✓ uses standard circle form with correct radius✓ correct equation |

(ii) State, with justification, whether the point (9, -8) lies on the circle. (1 mark)

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| **Solution** |
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| **Specific behaviours** |
| ✓ substitutes point into equation from (a) and interprets |

(b) Determine the centre and radius of the circle with equation  .

 (3 marks)

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| **Solution** |
| Hence centre at (2, -3) and radius 2 |
| **Specific behaviours** |
| ✓ factors x terms✓ factors y terms✓ states centre and radius |

(c) Find the equation of the curve drawn below. (3 marks)

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| **Solution** |
| $$y=k\sqrt{x+b}+c$$$$y=2\sqrt{x+3}-2$$ |
| **Specific behaviours** |
| ✓ $a=3$✓ $k=2$✓ $c=-2$ |

Question 3 (1.1.14) (2, 2, 2 = 6 marks)

A rectangular hyperbola has asymptotes with equation $x=-2$ and $y=4$.

1. Write two possible equations for this function

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| **Solution** |
| $y=\frac{a}{x+2}+4$ so a could be any number eg $y=\frac{1}{x+2}+4$ and $y=\frac{-1}{x+2}+4$ |
| **Specific behaviours** |
| ✓✓ two possible equations |

1. Write the equation of this function if it has a *y*-intercept at (0,5)

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| **Solution** |
| $5=\frac{a}{0+2}+4$ so a=2 |
| **Specific behaviours** |
| ✓ substitutes correctly into equation✓a=2 |

1. Write the equation of this function if it passes through the point (3,5)

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| **Solution** |
| $5=\frac{a}{3+2}+4$ so a=5 therefore y$=\frac{5}{x+2}+4$ |
| **Specific behaviours** |
| ✓ substitutes correctly into equation✓ states equation |

Question 4 (1.1.24) (1, 2, 1, 2 = 6 marks)

1. Given $f\left(x\right)=x^{2}-2x$
2. What type of correspondence does $f$ show? Circle one of the following.

Many-to-one One-to-many One-to-one

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| **Specific behaviours** |
| ✓ Many to one |

1. If the domain of $f $is $f\left(x\right)\in R, -4\leq x\leq 5$, find the range of $f.$

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| **Specific behaviours** |
| ✓✓ $-1\leq y\leq $ 24 |

1. Given $y=2+\sqrt{4-x^{2}}$
2. What is the largest possible value of $y$.

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| **Specific behaviours** |
| ✓ $y=$ 4 |

1. Determine the domain and range.

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| **Specific behaviours** |
| ✓ $-2\leq x\leq $ $2$✓ $ 2\leq y\leq $ $4$ |

Question 5 (1.1.24) (1, 1, 2, 2 = 6 marks)

Suppose $G\left(x\right)=\frac{2x-3}{x-4}$.

1. Evaluate $G\left(2\right)$

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| **Solution** |
| ✓ $-\frac{1}{2}$ |

1. Find a value of x such that $G\left(x\right)$ does not exist.

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| **Solution** |
| ✓ $x=4$ |

1. Find $G(x+2)$ in simplest form.

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| **Solution** |
| $$g\left(x+2\right)=(2\left(x+2\right)-3)/(\left(x+2\right)-4$$$$g\left(x+2\right)=\frac{2x+1}{x-2}$$ |
| **Specific behaviours** |
| ✓Substitute correctly✓ Answer |

1. Find *x* such that $G\left(x\right)= -3.$

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| **Solution** |
| $$-3=\frac{2x-3}{x-4}$$$$x=3$$ |
| **Specific behaviours** |
| ✓Sets equation up correctly✓ Answer |