MPM2D – Exam Review Package

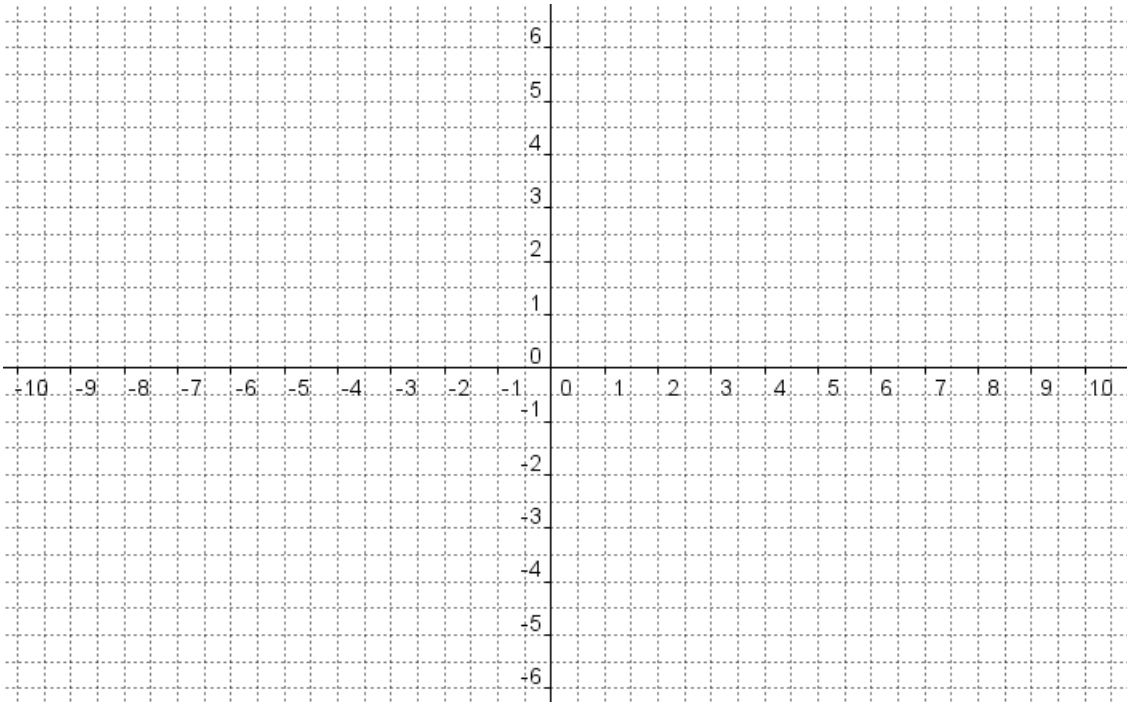
1. Classify each polynomial by degree and by number of terms.
   a. $3x^2 – 2x$
   b. $4a^2b^3$
   c. $8 + 2x^4y^4 + 3x^3y^3$
   d. $4x^5y – 2x^3y^2 + x^2y^3 + 4$

2. Simplify each expression.
   a. $(6y – 2) + (2y + 8)$
   b. $(8 + 6x) – (9 + x)$
   c. $(3x^2 + 2x – 6) + (2x^2 – 4x + 7)$
   d. $(5a^2b + 2ab – 3b^2) – (6a^2b – 3ab + b^2)$
   e. $(3ab)(-2ab^2)(2a^3)$
   f. $(-6x^2yz)(-5y^3z)$
   g. $\frac{-21x^2y^2z}{-7xy^2z}$
   h. $-\frac{32p^2q^4}{8p^2q^3}$

3. Expand and simplify each expression.
   a. $4m(m^2 – mn – n^2) – 2n(6m^2 + mn + 4n^2)$
   b. $2(m – 3)(m + 8)$
   c. $3(6x – 2y)(2x – 3y)$
   d. $(y – 4)(y – 3) – (y – 2)(y – 5)$
   e. $6(m – 2)(m + 3) -3(3m – 4)$
   f. $(x + 4)^2$
   g. $(y – 7)^2$
   h. $(x – 5)(x + 5)$
   i. $(5m + 2n)(5m – 2n)$
   j. $3(2b – 1)^2 -2(4b – 5)^2$
   k. $4x^2 – (2 – 3x)^2 + 6(2x – 1)(2x + 1)$
   l. $-5 (x – 6)^2 - 8$

4. Complete the table below and then graph the functions on the grid provided.

Equation	Vertex	Direction of Opening	Equation of the Axis of Symmetry	Maximum or Minimum Point	Maximum or Minimum Value
$y=(x+3)^2-2$					
$y=-(x-4)^2-3$					
$y=2(x-1)^2+1$					
$y=-\frac{1}{2}(x+6)^2+5$					

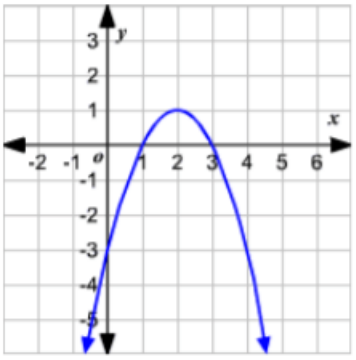


5. Complete the table below.

Equation	Domain	Range
$y=(x+3)^2-2$		
$y=-(x-4)^2-3$		
$y=2(x-1)^2+1$		
$y=-\frac{1}{2}(x+6)^2+5$		

6. Write an equation for a quadratic relation that has a vertex (3, -1) and has been vertically stretched by a factor of 2 and opens down.

7. Write an equation for the quadratic relation shown.



8. Factor each expression below.
   a. $50r^2 - 72$
   b. $2ax + 10ay – 8az$
   c. $3x^3y^2 – 12x^2y^3 + 18x^2y + 15xy^2$
   d. $3x(y – z) - 2(y – z)$
   e. $4x(r + 6) - (r + 6)$
   f. $x^2 – 5x + 6$
   g. $a^2 + 6a + 5$
   h. $x^2 – 5x – 66$
   i. $m^2 + 12m + 32$
   j. $4x^2 – 16x – 48$
   k. $2x^2 – 16x – 66$
   l. $3y^2 + y – 4$
   m. $20x^2 – 7x – 6$
   n. $18y^2 + 15y – 18$
   o. $8m^2 + 6m – 20$
   p. $15x^2 – 13x - 2$
   q. $9x^2 + 3x – 20$
   r. $x^2 – 25$
   s. $49 – 64m^2$
   t. $81x^2 – 121$
   u. $16a^2 + 40a + 25$
   v. $4x^2 – 36$
   w. $36x^2 – 81y^2$

9. Convert each of the following quadratic relations into vertex form. Then determine if each relation has a maximum or minimum value and state the value of x for which it occurs.
    a. $y = 3x^2 – 18x + 1$
    b. $y = -4x^2 – 32x – 11$
    c. $y = -7x^2 + 84x + 19$
    d. $y = 4x^2 – 40x + 7$

10. Find the x-intercepts of each of the following quadratic equations using the most appropriate algebraic method.
    a. $3(x – 7)^2 – 15 = 0$
    b. $2x^2 + 4x – 30 = 0$
    c. $3x^2 – 2x – 11 = x^2 – 5x$

11. Phil wants to make the largest possible rectangular vegetable garden using 18 m of fencing. The garden is right behind the back of his house, so he has to fence it only on three sides. Determine the dimensions that maximize the area of the garden.

12. The length of a rectangle is 2 m more than the width. The area is 48 m^2. Find the dimensions of the rectangle.

13. The sum of the squares of three consecutive integers is 77. Find the integers.

14. The hypotenuse of a right triangle is 15 cm. The other two sides have a total length of 21 cm. Find the lengths of the two unknown sides.

15. The sum of the squares of three consecutive odd integers is 875. Find the integers.

16. A rectangular skating rink measures 40 m by 20 m. It is to be doubled in area by extending each side by the same amount. Determine how much each side should be extended, to the nearest tenth of a metre.

17. Accountants for the Hitech running shoe company have determined that the relation $P = -2x^2 + 20x – 42$ models the company's profit for the next quarter. P represents the profit (in hundred thousands $) and x represents the number of pairs of shoes sold (in hundred thousands).
    a. How many pairs of shoes must they sell to maximize the profit?
    b. What is the maximum profit the company can expect to earn in the quarter?

18. The height h, in metres, of a snowboarder above the ground is given by $h = -4.9(t-2)^2 + 25$, where t is the time, in seconds, since the snowboarder left a jump.
    a. What is the maximum height of the snowboarder?
    b. When does the snowboarder reach this height?
    c. What is the initial height of the snowboarder when he leaves the ramp?
    d. When does the snowboarder hit the ground?

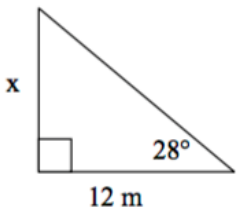
19. A study compared the speed x (in miles per hour) and the average fuel consumption y (in miles per gallon) for cars and the study resulted in the quadratic relation $y = -0.00875x^2 + 0.775x + 13$.
    a. Determine the speed that results in minimum fuel consumption.
    b. Determine the fuel consumption at the speed determined in part a.

20. Determine the x-intercepts of each quadratic relation below.
    a. $(x - 2)(x + 7) = 0$
    b. $6x^2 - 7x - 3 = 0$
    c. $7x^2 - 35x = 0$
    d. $(2x + 5)(2x + 5) = 0$
    e. $x^2 - 6x + 8 = 0$
    f. $6x^2 = x + 35$
    g. $\frac{5x^2}{4} - 5 = \frac{15x}{4}$
    h. $x^2 - 8x + 12 = 0$
    i. $3x^2 - 6x - 8 = 0$
    j. $4x^2 + 32x - 3 = 0$

21. Sketch the graphs of the following quadratic equations by locating the x-intercepts and then finding the coordinates of the vertex.
    a. $y = (x - 3)(x - 5)$
    b. $y = x^2 - 7x + 12$
    c. $y = -(x - 1)(x - 9)$

22. Calculate x to the nearest hundredth of a metre.

a.



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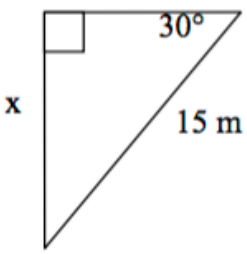

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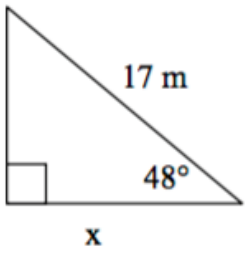
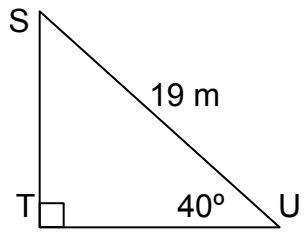


23. Solve each triangle. Round each side length to the nearest hundredth and each angle to the nearest degree.

a.



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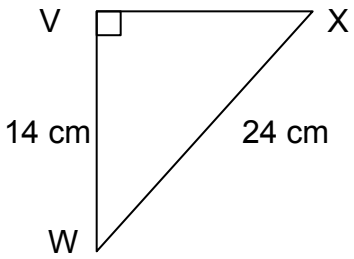
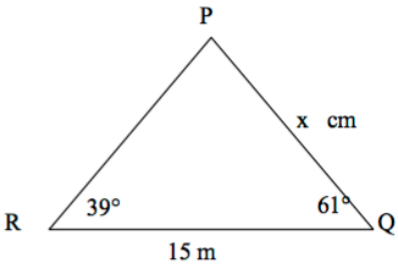
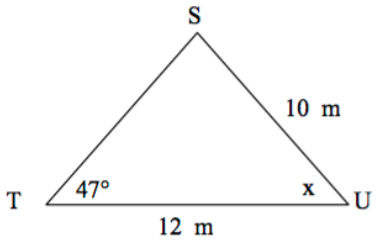


24. Solve each triangle. Round each side length to the nearest hundredth and each angle to the nearest degree.

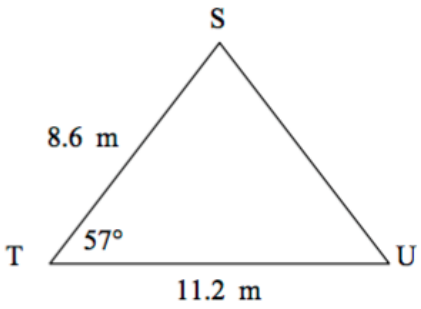
a.



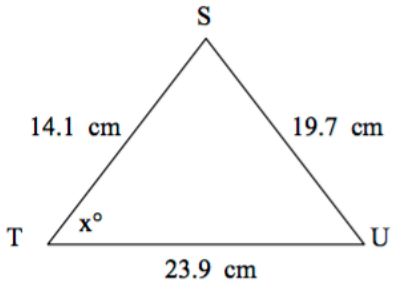
b.



c.



d.



25. In ΔABC, A = 50°, a = 9m, and b = 8m. Determine B.

26. In ΔKLM, k = 54.2 cm, l = 45.7 cm, and m = 36.9 m. Find K.

27. Solve each linear system.

a. $\begin{aligned} 3x + y &= 17 \\ 2x - y &= -2 \end{aligned}$

b. $\begin{aligned} 3x - 4y &= 5 \\ 5x + 3y &= -11 \end{aligned}$

c. $\begin{aligned} \frac{x}{6} + \frac{y}{4} &= 6 \\ \frac{5x}{6} - \frac{y}{3} &= 11 \end{aligned}$

28. Set up each of the word problems below. Please create a let statement to explain your variables and two equations to represent the scenario.
    a. A supermarket sells 2 kg and 4 kg bags of sugar. A shipment of 1100 bags of sugar has a total mass of 2900 kg. How many 2 kg and how many 4 kg bags were in the shipment?

    b. The school car was charged $5 for a car and $6 for a van. A total of 86 cars and vans were washed on Saturday and the amount earned was $475. How many of each vehicle was washed?

    c. A lab technician needs to combine some 30% alcohol solutions and 35% alcohol solution to make 5 L of 33% alcohol solution. How many litres of the 30% solutions and the 35% solution will be used?

    d. As the owner of a banquet hall, you are in charge of catering a reception. There are two dinners: a chicken dish that costs $16 and a beef dish that costs $18. The 300 wedding guests have ordered their meals in advance, and the total cost to prepare the dinner is $5256. How many of each type of dinner do you need to prepare?

    e. How many ounces of dried apricots must be added to 18 ounces of a snack mix that contains 20% dried apricots to make a mixture that is 25% dried apricots?

29. Find the shortest distance from the point S (3, 8) to the equation $y = \frac{2}{7}x + \frac{18}{7}$.

30. A house is to be connected to a new water main that runs along the line $y = x - 1$. The connection point at the house has coordinates (2, 9), where the units represent metres. What length of pipe is needed to connect the water main at the closes point?

31. Determine the length of the line segment joining each pair of points.
    a. A (3, 7) and B (-1, -5)
    b. C (0, 5) and D (6, 10)

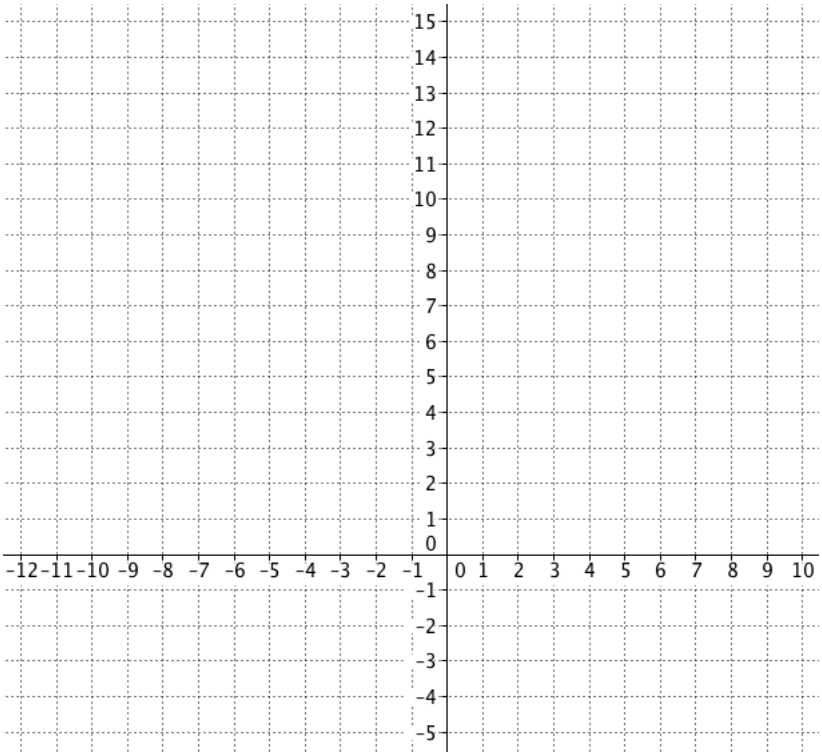
32. Write the equation for a circle with its centre at the origin, (0, 0), that passes through the point (3, 4).

33. Determine the midpoint of each line segment with the given endpoints.
    a. A (-6, 2) and B (4, 8)
    b. C (-200, -100) and D (350, 600)

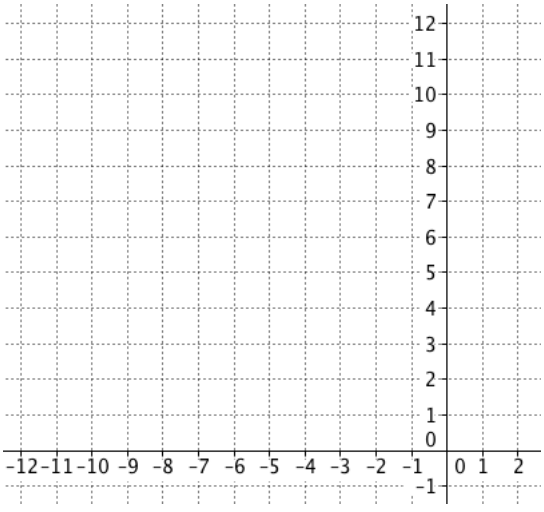
34. Find the second endpoint of a line segment given the midpoint, M, and one endpoint, C.
    a. C (9, -10) and M (4, 8)
    b. C (-9, 7) and M (10, -3)

35. A quadrilateral PQRS has vetices P (2, 3), Q (8, 5), R (11, -4), and S (5, -6). Determine what type of quadrilateral PQRS is.

36. Determine the area of the triangle with vertices T (10, –3), U (–10, 9) and V (–12, –5).



37. Determine the centre of the circle that passes through A (–11, 2), B (–7, 8) and C (3, 12).



Answer Key

1a) degree 2, binomial
1b) degree 5, monomial
1c) degree 8, triomial
1d) degree 6, polynomial

2a) $8y + 6$ b) $5x - 1$ c) $5x^2 – 2x + 1$ d) $–a^2b + 5ab – 4b^2$
e) $-12a^5b^3$ f) $30x^2y^4z^2$ g) $3x$ h) $-4q$

3a) $4m^3 – 16m^2n – 6mn^2 – 8n^3$ b) $2m^2 + 10m - 48$ c) $36x^2-66xy+18y^2$
d) z e) $6m^2 – 3m - 24$ f) $x^2 + 8x + 16$ g) $y^2 – 14y + 49$
h) $x^2 - 25$ i) $25m^2 – 4n^2$ j) $-20b^2 + 68b - 47$ k) $19x^2 + 12x - 10$
l) $-5x^2 + 60x - 188$

4a) V(-3, -2)	Opens up	x = -3	minimum	y = -2
b) V (4, -3)	Opens down	x = 4	maximum	y = -3
c) V (1, 1)	Opens up	x = 1	minimum	y = 1
d) V (-6, 5)	Opens down	x = -6	maximum	y = 5

5a) $D=\{x\in R\}$, $R=\{y\geq -2, y\in R\}$ b) $D=\{x\in R\}$, $R=\{y\leq -3, y\in R\}$ c) $D=\{x\in R\}$, $R=\{y\geq 1, y\in R\}$ d) $D=\{x\in R\}$, $R=\{y\leq 5, y\in R\}$

6) $y = -2(x – 3)^2 - 1$ 7) $y = -(x – 2)^2 + 1$ 8a) $2(5r – 6)(5r + 6)$ b) $2a(x + 5y – 4z)$
8a) $2(5r – 6)(5r + 6)$ b) $2a(x + 5y – 4z)$ c) $3xy(x^2y – 4xy^2 + 6x + 5y)$
8d) $(y – z)(3x – 2)$ e) $(r + 6)(4x – 1)$ f) $(x – 2)(x – 3)$ g) $(a + 5)(a + 1)$
h) $(x – 11)(x + 6)$ i) $(m + 8)(m + 4)$ j) $4(x – 6)(x + 2)$ k) $2(x – 11)(x + 3)$
l)($(3y + 4)(y – 1)$ m) $(4x + 1)(5x – 3)$ n) $3(3y – 2)(2y + 3)$ o) $2(4m – 5)(m + 2)$
p) $(15x + 2)(x – 1)$ q) $(3x + 5)(3x – 4)$ r) $(x – 5)(x + 5)$ s) $(7 – 8m)(7 + 8m)$
t) $(9x –11)(9x + 11)$ u) $(4a + 5)(4a – 5)$ v) $4(x – 3)(x + 3)$ w) $9(2x–3y)(2x+3y)$

9a) $y = 3(x – 3)^2 – 26$, minimum of y = -26 when x = 3
9b) $y = -4(x + 4)^2 + 53$, maximum of y = 53 when x = -4
9c) $y = -7(x – 6)^2 + 271$, maximum of y = 271 when x = 6
9d) $y = 4(x – 5)^2 – 93$, minimum of y = -93 when x = 5

10) $x_1 \approx 9.24$, $x_2 \approx 4.76$ b) $x_1 = 5$, $x_2 = 3$ c) $x_1 \approx 1.71$, $x_2 \approx -3.21$
11) 4.5 m by 9 m 12) 6 m by 8 m 13) -4, -5, -6 and 4, 5, 6
14) 9cm and 12cm 15) 15, 17, 19 and -15, -17, -19 16) 5.62 m
17a) 500 000 pairs of shoes (x = 5) b) $800 000 (P = 8)
18a) 18 m b) 2 seconds c) 5.4 m d) 4.26 seconds
19a) ≈44.29 mph b) ≈30.16 miles per gallon
20a) $x_1 = 2$, $x_2 = -7$ b) $x_1 = 3/2$ $x_2 = -1/3$ c) $x_1 = 0$ $x_2 = 5$ d) $x = -5/2$
e) $x_1 = 4$ $x_2 = 2$ f) $x_1 = 5/2$ $x_2 = -7/3$ g) $x_1 = 4$ $x_2 = -1$ h) $x_1 = 6$ $x_2 = 2$
i) $x_1 \approx 2.91$, $x_2 \approx -0.91$ j) $x_1 \approx 0.09$, $x_2 \approx -8.09$
21a) $x_1 = 3$, $x_2 = 5$ V (4, -1) b) $x_1 = 4$ $x_2 = 3$ V (7/2, -1/4) c) $x_1 = 1$ $x_2 = 9$ V (5, 16)
22a) $x \approx 5.63$ m b) $x = 7.5$ m c) $x \approx 11.38$ m
23) S = 50º s ≈ 14.55 m u ≈ 12.21 m b) w ≈ 19.49 cm X ≈ 36º W ≈ 54º
24) P = 80º r ≈ 9,59 m q ≈ 13.32 m b) S ≈ 61º U = 72º u ≈ 13.00 m

c) $t \approx 9.72$ m $S \approx 75°$ $U = 48°$ d) $S \approx 88°$ $T \approx 55°$ $U = 37°$

25) $B \approx 43°$ 26) $K \approx 81°$

27a) POI (3, 8) b) POI (-1, -2) c) POI (18, 12)

28a) Let x by the number of 2-kg bags of sugar. Let y be the number of 4-kg bags of sugar. $x + y = 1100$ $2x + 4y = 2900$

28b) Let x be the number of cars washed. Let y be the number of vans washed. $x + y = 86$ $5x + 6y = 475$

28c) Let x be the amount of 30% solution used. Let y be the amount of 35% solution used. $x + y = 5$ $0.30x + 0.35y = 1.65$

28d) Let x be the number of chicken dinners ordered. Let y be the number of beef dinners ordered. $x + y = 300$ $16x + 18y = 5256$

28e) Let x be the amount of pure apricots added. Let y be the amount of the new mixture made. $x + 18 = y$ $x + 3.6 = 0.25y$

29) $L \approx 4.40$ units 30) $L \approx \sqrt{32}$ units 31a) $L \approx \sqrt{160}$ units $L \approx \sqrt{61}$ units

32) $x^2 + y^2 = 25$ 33) M (-1, 5) b) M (75, 250)

34a) D (-1, 26) b) D (29, -13)

35) $L_{PQ} = \sqrt{40}$ units $L_{QR} = \sqrt{90}$ units $L_{RS} = \sqrt{40}$ units $L_{PS} = \sqrt{90}$ units

$m_{PQ} = 1/3$ $m_{QR} = -3$ $m_{RS} = 1/3$ $m_{PS} = -3$

Opposite sides are parallel ($m_{PQ} = m_{RS}$ and $m_{PS} = m_{QR}$)

Corners meet at 90º (m_{PQ} is perpendicular to m_{QR})

Opposite sides have equal lengths ($L_{PQ} = L_{RS}$ and $L_{PS} = L_{QR}$)

Therefore the quadrilateral is a rectangle

36) The area of the triangle is 152 units^2

37) The centre of the circle is $\left(\frac{36}{11}, -\frac{105}{33}\right)$