

1. a) $2[3(-4) - 7 + 0]$
 $= 2[-12 + 1]$
 $= 2[-11]$
 $= -22$

b) $\frac{-8}{9} - (-\frac{5}{8})$
 $= \frac{-64}{72} - (-\frac{45}{72})$
 $= \frac{-19}{72}$

c) $5 - 6[3(-4) - (-1)]$
 $= 5 - 6[-12 + 1]$
 $= 5 - 6[-11]$
 $= 5 + 66$
 $= 71$

d) $\frac{7}{8} \div (-\frac{3}{4})$
 $= \frac{7}{8} \times \frac{-4}{3}$
 $= \frac{-28}{24}$
 $= -\frac{7}{6}$

e) $\frac{3}{1}(-\frac{1}{4}) + \frac{2}{1}(-\frac{2}{3}) - \frac{5}{1}(-\frac{1}{4})(\frac{2}{3})$
 $= -\frac{3}{4} - \frac{4}{3} - \frac{10}{12}$
 $= -\frac{9}{12} - \frac{16}{12} - \frac{10}{12}$
 $= -\frac{35}{12}$

f) 2^4
 $= 16$

g) $(\frac{2}{3})^2$
 $= \frac{4}{9}$

h) $(\frac{3}{4})^{-2}$
 $= (\frac{4}{3})^2$
 $= \frac{16}{9}$

i) $(1.5)^0$
 $= 1$

j) $2^3 + 2^{-3}$
 $= 8 + (\frac{1}{2})^3$
 $= 8 + \frac{1}{8}$
 $= \frac{64}{8} + \frac{1}{8}$
 $= \frac{65}{8}$

k) $(3^2 - 2^2)^{-2}$
 $= (9 - 4)^{-2}$
 $= (5)^{-2}$
 $= (\frac{1}{5})^2$
 $= \frac{1}{25}$

2. $y = -x + 5$ ①
 $3x - y - 3 = 0$ ②

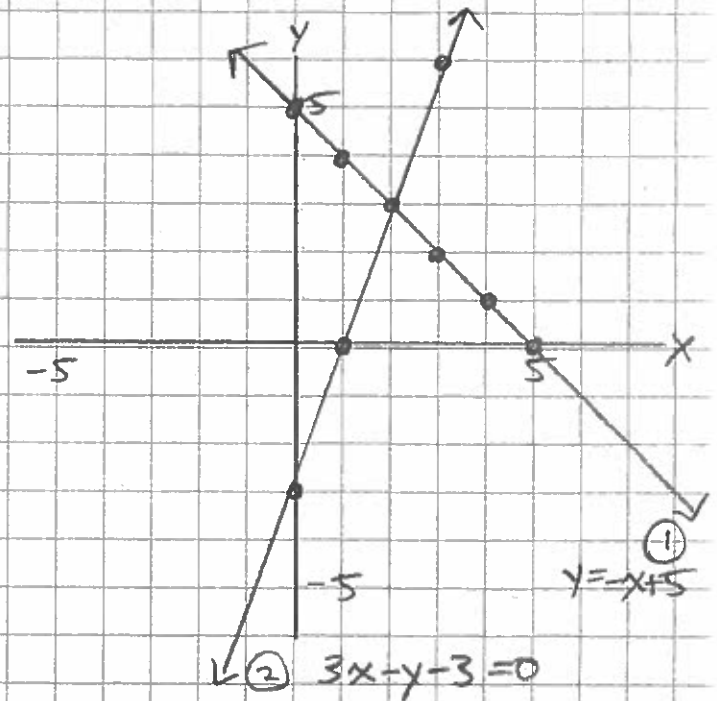
$m = -1$ $b = 5$

$\frac{-y}{-1} = \frac{-3x + 3}{-1}$

$m = 3$ $b = -3$

$y = 3x - 3$

∴ the solution is (2, 3).



3. a) $x + 2y = 4$ ① $\rightarrow x = 4 - 2y$ ①
 $2x - 3y = 7$ ②

sub ① into ②
 $2(4 - 2y) - 3y = 7$
 $8 - 4y - 3y = 7$
 $-7y = -1$
 $y = \frac{1}{7}$

sub $y = \frac{1}{7}$ into ①
 $x = 4 - 2(\frac{1}{7})$
 $x = 4 - \frac{2}{7}$
 $x = \frac{28}{7} - \frac{2}{7}$
 $x = \frac{26}{7}$

\therefore the solution is $(\frac{26}{7}, \frac{1}{7})$

b) $y = 2x + 3$ ① pg 2 of 21
 $4x + y = 8$ ②

sub ① into ②
 $4x + 2x + 3 = 8$
 $6x = 5$
 $x = \frac{5}{6}$

sub $x = \frac{5}{6}$ into ①
 $y = 2(\frac{5}{6} + 3)$
 $y = \frac{10}{6} + 3$
 $y = \frac{10}{6} + \frac{18}{6}$
 $y = \frac{28}{6}$
 $y = \frac{14}{3}$

\therefore the solution is $(\frac{5}{6}, \frac{14}{3})$

4. a) $3x + 8y = -3$ ①
 $-5x + 8y = -5$ ②
 $\underline{-2x} \quad = 2$
 $x = -1$

sub $x = -1$ into ①
 $3(-1) + 8y = -3$
 $-3 + 8y = -3$
 $8y = 0$
 $y = 0$

\therefore the solution is $(-1, 0)$

b) $11m + 3n = 25$ ①
 $+ -11m + 7n = -15$ ②
 $10n = 10$
 $n = 1$

sub $n = 1$ into ①
 $11m + 3(1) = 25$
 $11m = 25 - 3$
 $11m = 22$
 $m = 2$

\therefore the solution is $(2, 1)$

c) $3x - 4y = 10$ ① $\times 2$ $6x - 8y = 20$
 $2x - 3y = 7$ ② $\times 3$ $-6x - 9y = 21$
 $\underline{\hspace{1.5cm}}$
 $y = -1$

sub $y = -1$ into ①
 $3x - 4(-1) = 10$
 $3x + 4 = 10$
 $3x = 6$
 $x = 2$

\therefore the solution is $(2, -1)$

4. d) $4x - 5y = -22$ ① $\times 5$ $20x - 25y = -110$ My sum <1
 $5x + 6y = -3$ ② $\times 4$ $-20x + 24y = -12$ sub $y=2$ into ①
 $-49y = -98$ $4x - 5(2) = -22$
 $y = 2$ $4x - 10 = -22$
 $4x = -12$
 $x = -3$

\therefore the solution is $(-3, 2)$.

5. Let x be the length.
Let y be the width.

$$2x + 2y = 50 \quad \text{①}$$

$$x = y + 7 \quad \text{②}$$

sub ② into ①

$$2(y + 7) + 2y = 50$$

$$2y + 14 + 2y = 50$$

$$4y = 36$$

$$y = 9$$

sub $y=9$ into ②

$$x = 9 + 7$$

$$x = 16$$

\therefore the dimensions are 16 cm by 9 cm.

6. Let x be the amount invested at 3%.
Let y be the amount invested at 5%.

$$x + y = 20000 \quad \text{①}$$

$$0.03x + 0.05y = 760 \quad \text{②}$$

$$x = 20000 - y \quad \text{①}$$

sub ① into ②

$$0.03(20000 - y) + 0.05y = 760$$

$$600 - 0.03y + 0.05y = 760$$

$$0.02y = 160$$

$$y = 8000$$

sub $y=8000$ into ①

$$x = 20000 - 8000$$

$$x = 12000$$

\therefore Amy invested \$12000 at 3% and \$8000 at 5%.

7. Let x be the amount of Brand A Fertilizer.
Let y be the amount of Brand B Fertilizer.

$$x + y = 56 \quad \text{①}$$

$$0.32x + 0.18y = 0.24(56) \quad \text{②}$$

$$x = 56 - y \quad \text{①}$$

sub ① into ②

$$0.32(56 - y) + 0.18y = 13.44$$

$$17.92 - 0.32y + 0.18y = 13.44$$

$$-0.14y = -4.48$$

$$y = 32$$

sub $y=32$ into ①

$$x = 56 - 32$$

$$x = 24$$

\therefore 24 tonnes of Brand A and 32 tonnes of Brand B fertilizer.

8. Let x be the distance travelled on the 401.
Let y be the distance travelled on Highway 7.

$$\begin{aligned}
 x + y &= 480 \quad \textcircled{1} \\
 \frac{x}{100} + \frac{y}{60} &= 6 \quad \textcircled{2}
 \end{aligned}$$

time



$$\frac{600x}{100} + \frac{600y}{60} = 6 \times 600$$

$$\begin{aligned}
 6x + 10y &= 3600 \\
 -6x + 6y &= 2880 \quad \textcircled{1} \times 6 \\
 \hline
 4y &= 720 \\
 y &= 180
 \end{aligned}$$

$$\begin{aligned}
 \text{sub } y=180 \text{ into } \textcircled{1} \\
 x + 180 &= 480 \\
 x &= 300
 \end{aligned}$$

\therefore Gerry drove 300 km on the 401, and 180 km on Highway 7.

9. a) $y = x + 5$
 $y = x - 1$

same slope
different y-int
 \rightarrow parallel lines
 \therefore no solution

b) $4x - y = -3$
 $2x - y = -1$

$4x + 3 = y$
 $2x + 1 = y$
different slopes
 \therefore 1 solution

c) $y = -x + 4$
 $\frac{3y}{3} = \frac{-3x + 12}{3}$

$y = -x + 4$
same slope
same y-int
 \rightarrow coincidental line
 \therefore many solutions

UNIT 2: ANALYTIC GEOMETRY

10. a) $d = \sqrt{(5-2)^2 + (7-5)^2}$
 $d = \sqrt{(3)^2 + (2)^2}$
 $d = \sqrt{13}$
 $d = 3.6$ units

b) $d = \sqrt{(-2+1)^2 + (-4+3)^2}$
 $d = \sqrt{(-1)^2 + (-1)^2}$
 $d = \sqrt{2}$
 $d = 1.4$ units

11. a) $M = \left(\frac{-2+4}{2}, \frac{2+8}{2} \right)$
 $M = (1, 5)$

b) $M = \left(\frac{3+(-9)}{2}, \frac{3+3}{2} \right)$
 $M = (-3, 3)$

12. $M = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right)$
 $(-2, 1) = \left(\frac{-7+x_2}{2}, \frac{3+y_2}{2} \right)$
 $-2 = \frac{-7+x_2}{2} \quad 1 = \frac{3+y_2}{2}$
 $-4 = -7+x_2 \quad 2 = 3+y_2$
 $3 = x_2 \quad -1 = y_2$

\therefore the other end is $(3, -1)$.

$$13. \begin{aligned} x^2 + y^2 &= 15^2 \\ x^2 + y^2 &= 225 \end{aligned}$$

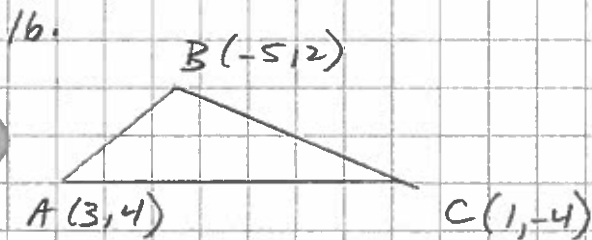
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$$14. \begin{aligned} r^2 &= 100 \\ r &= 10 \end{aligned}$$

side	Length
QR	$d = \sqrt{(5-5)^2 + (-3-6)^2}$ $d = \sqrt{(0)^2 + (-9)^2}$ $d = \sqrt{81}$ $d = 9$
RS	$d = \sqrt{(1-5)^2 + (-3+3)^2}$ $d = \sqrt{(-4)^2 + (0)^2}$ $d = \sqrt{16}$ $d = 4$

$$a) \text{ Perimeter} = 2(9) + 2(4) \\ = 18 + 8 \\ = \text{26 units}$$

$$b) \text{ Area} = 7 \times 4 \\ = \text{36 square units}$$



$$a) M_{AB} = \left(\frac{-5+3}{2}, \frac{2+4}{2} \right) = \left(-1, 3 \right) \leftarrow \text{"D"}$$

$$m_{CD} = \frac{3+4}{-1-1} \\ = \frac{7}{-2}$$

$$y = mx + b \quad m = -\frac{7}{2} \quad (-1, 3)$$

$$3 = -\frac{7}{2}(-1) + b$$

$$3 = \frac{7}{2} + b$$

$$\frac{b}{2} = \frac{7}{2} - 3 = b$$

$$-\frac{1}{2} = b$$

\therefore the equation of the median is $y = -\frac{7}{2}x - \frac{1}{2}$.

from part a)

$$b) M_{AB} = (-1, 3) \leftarrow \text{"H"}$$

$$m_{AB} = \frac{2-4}{-5-3} \\ = \frac{-2}{-8} \\ = \frac{1}{4}$$

$$m_{\perp} = 4 \quad (-1, 3)$$

$$y = mx + b$$

$$3 = 4(-1) + b$$

$$3 = -4 + b$$

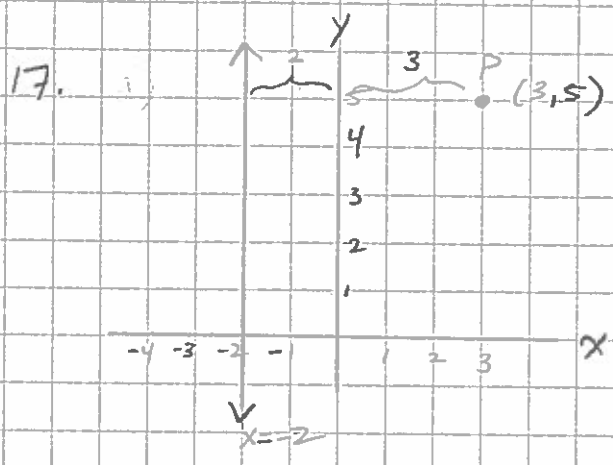
$$-1 = b$$

\therefore the equation of the right bisector is $y = -4x - 1$.

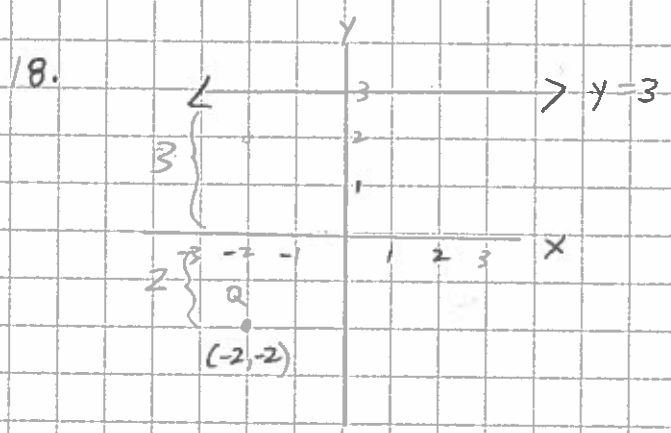
16. c) $m_{AB} = \frac{1}{4}$ from part b)
 $m = -4$

$y = mx + b$ $m = -4$ $(1, -4)$
 $-4 = -4(1) + b$
 $0 = b$

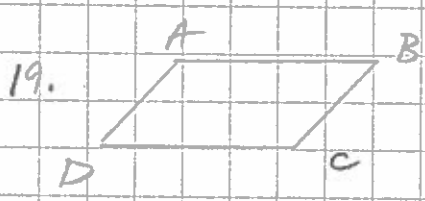
\therefore the equation of the altitude is $y = -4x$



$d = 2 + 3$
 $d = 5$ units



$d = 2 + 3$
 $d = 5$ units



$M_{AC} = \left(\frac{-2+7}{2}, \frac{-2+4}{2} \right)$
 $= \left(\frac{5}{2}, \frac{2}{2} \right)$
 $= (2.5, 1)$

$M_{BD} = \left(\frac{3+2}{2}, \frac{3+1}{2} \right)$
 $= \left(\frac{5}{2}, \frac{2}{2} \right)$
 $= (2.5, 1)$

Since $M_{AC} = M_{BD}$, the diagonals bisect each other.

20. a) $(4x+3) + (5x+4)$
 $= 9x+7$

b) $(2x^2-3x+4) - (x^2+4x-1)$
 $= 2x^2-3x+4-x^2-4x+1$
 $= x^2-7x+5$

21. a) $3(x+5) + 4(x-3)$
 $= 3x+15+4x-12$
 $= 7x+3$

b) $5(t+7) - 9(t-2)$
 $= 5t+35-9t+18$
 $= -4t+53$

c) $3x(2x-4) - x(x+5)$
 $= 6x^2-12x-x^2-5x$
 $= 5x^2-17x$

d) $4(x^2-2x+5) - (2x^2+3x-2)$
 $= 4x^2-8x+20-2x^2-3x+2$
 $= -2x^2-11x+22$

e) $2(3x-2)(3x+2)$
 $= 2(9x^2+6x-6x-4)$
 $= 18x^2-8$

f) $4(2x+1)(x-5)$
 $= 4(2x^2-10x+x-5)$
 $= 8x^2-36x-20$

g) $3(y+2)(y-3) + 2(y-4)(y+1)$
 $= 3(y^2-3y+2y-6) + 2(y^2+y-4y-4)$
 $= 3y^2-3y-18+2y^2-6y-8$
 $= 5y^2-9y-26$

h) $2(2x-3)(x+4) - (4x+1)(x+2)$
 $= 2(2x^2+8x-3x-12) - (4x^2+8x+x+2)$
 $= 4x^2+10x-24-4x^2-9x-2$
 $= x-26$

i) $(x+2)^2$
 $= (x+2)(x+2)$
 $= x^2+2x+2x+4$
 $= x^2+4x+4$

j) $(3x-1)^2$
 $= (3x-1)(3x-1)$
 $= 9x^2-3x-3x+1$
 $= 9x^2-6x+1$

22. a) $7x+42$
 $= 7(x+6)$

b) $4x^2-28x$
 $= 4x(x-7)$

c) $6xy-7st$ doesn't factor
 d) $14r^2t-7rt+21t^2$
 $= 7rt(2r-1+3t)$

23. a) $x^2+7x+12$ $\begin{matrix} 1 & 2 \\ 12 & 6 \end{matrix}$ $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$
 $= (x+3)(x+4)$

b) y^2+y-6 $\begin{matrix} 1 & 2 \\ 6 & 3 \end{matrix}$ $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$
 $= (y-2)(y+3)$

c) k^2+k+1 $\begin{matrix} 1 & 1 \\ 1 & 1 \end{matrix}$
 doesn't factor

d) $x^2-2x-15$ $\begin{matrix} 1 & 3 \\ 15 & -5 \end{matrix}$ $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$
 $= (x+3)(x-5)$

$$23. e) y^2 + 10y + 21 \quad 21 \begin{pmatrix} 3 \\ 7 \end{pmatrix} \\ = (y+3)(y+7)$$

$$f) x^2 - 11x + 18 \quad 18 \begin{pmatrix} -2 \\ -9 \end{pmatrix} \begin{matrix} 3 \\ 6 \end{matrix} \\ = (x-2)(x-9)$$

$$24. a) 2x^2 - 6x - 8 \\ = 2(x^2 - 3x - 4) \quad \begin{pmatrix} 1 \\ -4 \end{pmatrix} \begin{matrix} 2 \\ 2 \end{matrix} \\ = 2(x+1)(x-4)$$

$$b) 3x^2 + 12x + 9 \\ = 3(x^2 + 4x + 3) \quad 3 \\ = 3(x+1)(x+3)$$

$$c) 2xt - 6x - 3t + 9 \\ = 2x(t-3) - 3(t-3) \\ = (t-3)(2x-3)$$

$$d) xy + x - 2y - 2 \quad \text{change sign in question} \\ = x(y+1) - 2(y+1) \\ = (y+1)(x-2)$$

$$25. a) 3x^2 + 5x - 2 \quad \begin{pmatrix} 3 \\ 1 \end{pmatrix} \begin{matrix} 4 \\ 2 \end{matrix} \\ = (3x-1)(x+2)$$

$$b) 2y^2 + 11y + 12 \quad \begin{pmatrix} 2 \\ 1 \end{pmatrix} \begin{matrix} 12 \\ 6 \end{matrix} \\ = (2y+3)(y+4)$$

$$c) 4x^2 + 8x + 5 \quad 4 \begin{matrix} 4 \\ 1 \end{matrix} \begin{matrix} 2 \\ 5 \end{matrix} \\ \text{doesn't factor}$$

$$d) 4x^2 - 10x + 3 \quad 4 \begin{matrix} 4 \\ 2 \end{matrix} \begin{matrix} 3 \\ 1 \end{matrix} \\ \text{doesn't factor}$$

$$26. a) x^2 - 16 \\ = (x+4)(x-4)$$

$$b) y^2 + 10y + 25 \quad 25 \begin{pmatrix} 5 \\ 5 \end{pmatrix} \\ = (y+5)(y+5) \\ = (y+5)^2$$

$$c) x^2 + 9 \\ \text{doesn't factor}$$

$$d) x^2 - 6x + 9 \quad 9 \begin{pmatrix} 3 \\ 3 \end{pmatrix} \\ = (x-3)(x-3) \\ = (x-3)^2$$

$$27. a) 4x^2 + 6x - 10 \\ = 2(2x^2 + 3x - 5) \quad \begin{pmatrix} 1 \\ 2 \end{pmatrix} \begin{matrix} 2 \\ 5 \end{matrix} \\ = 2(x-1)(2x+5)$$

$$b) 18x^2 - 30x + 12 \\ = 6(3x^2 - 5x + 2) \quad \begin{pmatrix} 1 \\ 3 \end{pmatrix} \begin{matrix} 3 \\ 2 \end{matrix} \\ = 6(x-1)(3x-2)$$

$$c) 7x^2 - 7 \\ = 7(x^2 - 1) \\ = 7(x+1)(x-1)$$

$$d) 5x^2 - 10x + 20 \\ = 5(x^2 - 2x + 4) \quad 4 \begin{matrix} 2 \\ 2 \end{matrix}$$

28. (a) $y = (x-2)(x+4)$

Zeros: 2, -4

Vertex: $x = \frac{2+(-4)}{2}$

$= \frac{-2}{2}$

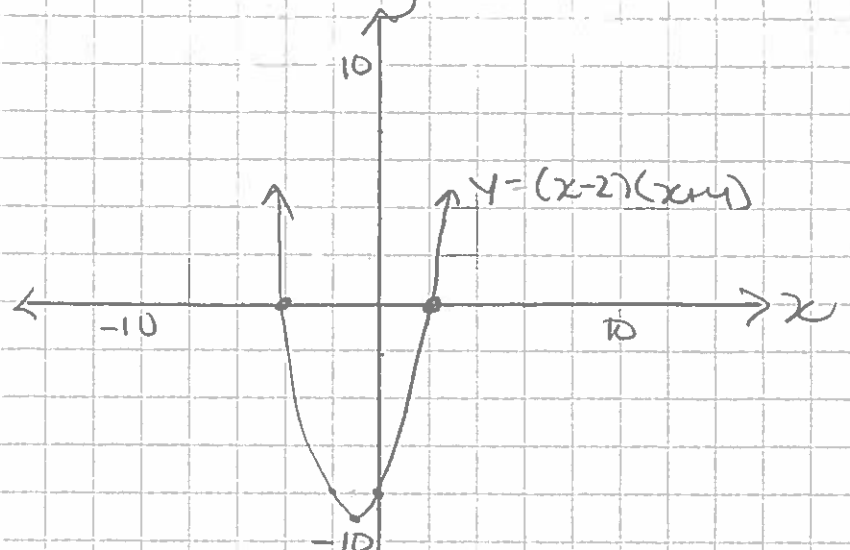
$= -1$

$y = (-1-2)(-1+4)$

$= (-3)(3)$

$= -9$

$\therefore (-1, -9)$ is the vertex



(b) $y = -2(x+1)(x-3)$

Zeros: -1, 3

Vertex: $x = \frac{-1+3}{2}$

$= \frac{2}{2}$

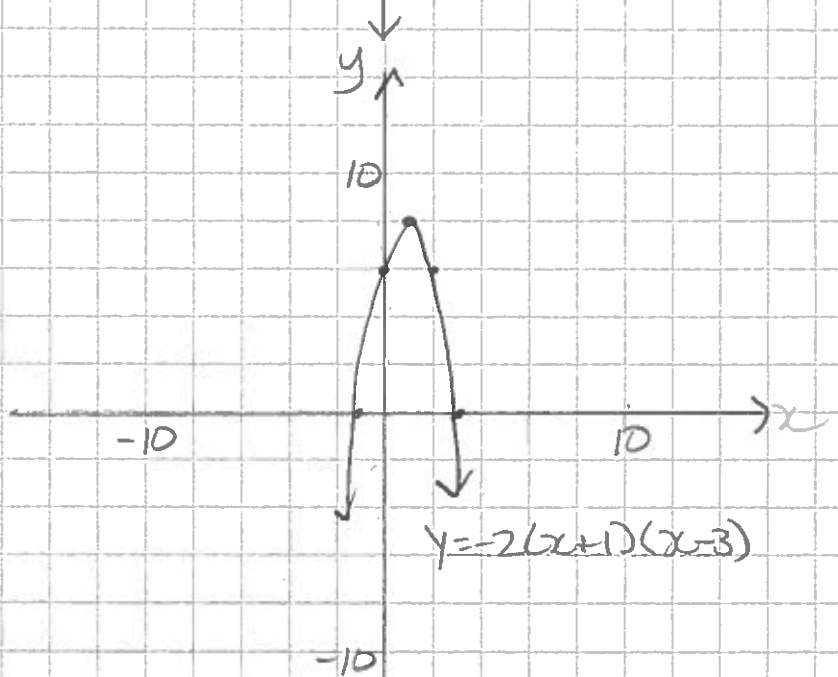
$= 1$

$y = -2(1+1)(1-3)$

$= -2(2)(-2)$

$= 8$

$\therefore (1, 8)$ is the vertex



(c) $y = x^2 + 6x$

$y = x(x+6)$

Zeros: 0, -6

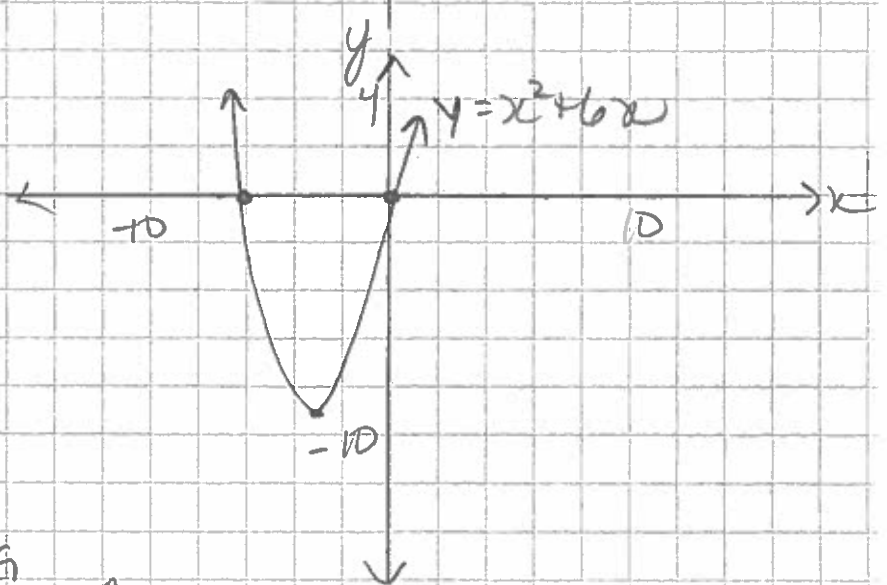
Vertex: $x = \frac{0+(-6)}{2}$

$= \frac{-6}{2}$

$= -3$

$y = (-3)^2 + 6(-3) = 9 - 18 = -9$

$\therefore (-3, -9)$ is the vertex



29. (a) $s = -2, t = 7$ pt $(0, -28)$

$$y = a(x-s)(x-t)$$

$$-28 = a(0+2)(0-7)$$

$$-28 = a(-14)$$

$$a = \frac{-28}{-14}$$

$$= 2$$

$$\therefore y = 2(x+2)(x-7)$$

(b) $x = \frac{-2+7}{2}$

$$= \frac{5}{2}$$

$$= 2.5$$

$$y = 2(2.5+2)(2.5-7)$$

$$= 2(4.5)(-4.5)$$

$$= -40.5$$

\therefore The vertex is $(2.5, -40.5)$

30. (a) $y = (x-2)^2 + 1$

Vertex: $(2, 1)$

axis of symmetry: $x = 2$

opening: up

(b) $y = -\frac{1}{2}(x+4)^2$

Vertex: $(-4, 0)$

axis of symmetry: $x = -4$

opening: down

31. (a) $y = (x^2 + 6x) + 3$

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

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

$$= (x+3)^2 - 12$$

(b) * Extra hard \rightarrow no fractions on exam!

$$y = \frac{1}{2}x^2 + 5x - 7$$

$$= \frac{1}{2}(x^2 + 10x) - 7$$

$$= \frac{1}{2}(x^2 + 10x + 25 - 25) - 7$$

$$= \frac{1}{2}(x^2 + 10x + 25) - 12.5 - 7$$

$$= \frac{1}{2}(x+5)^2 - 19.5$$

32. Vertex $(-1, -4) \rightarrow h = -1, k = -4$

pt $(3, 4) \rightarrow x = 3, y = 4$

$$y = a(x-h)^2 + k$$

$$4 = a(3+1)^2 - 4$$

$$8 = a(4)^2$$

$$8 = 16a$$

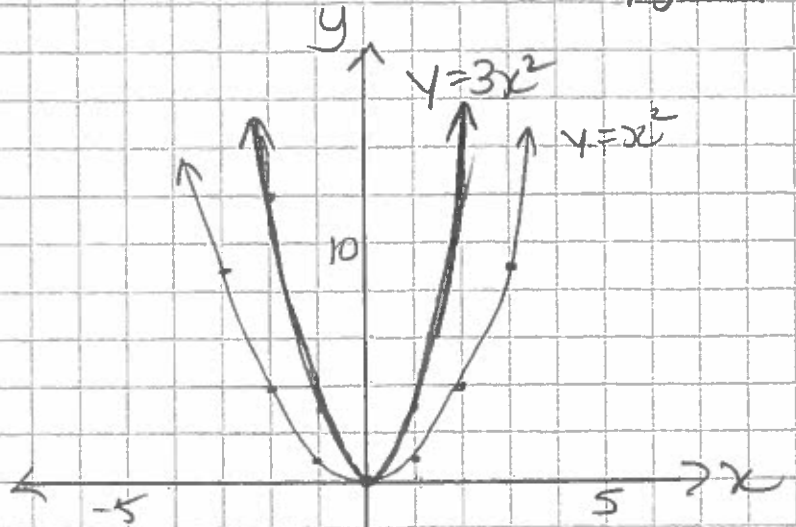
$$16 = 16$$

$$a = 1$$

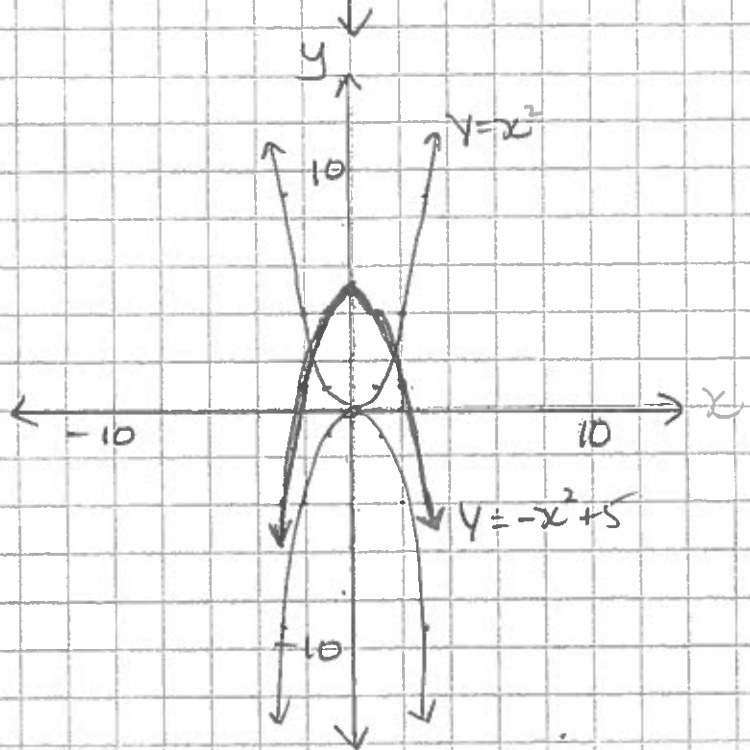
$$2$$

$$\therefore y = \frac{1}{2}(x+1)^2 - 4$$

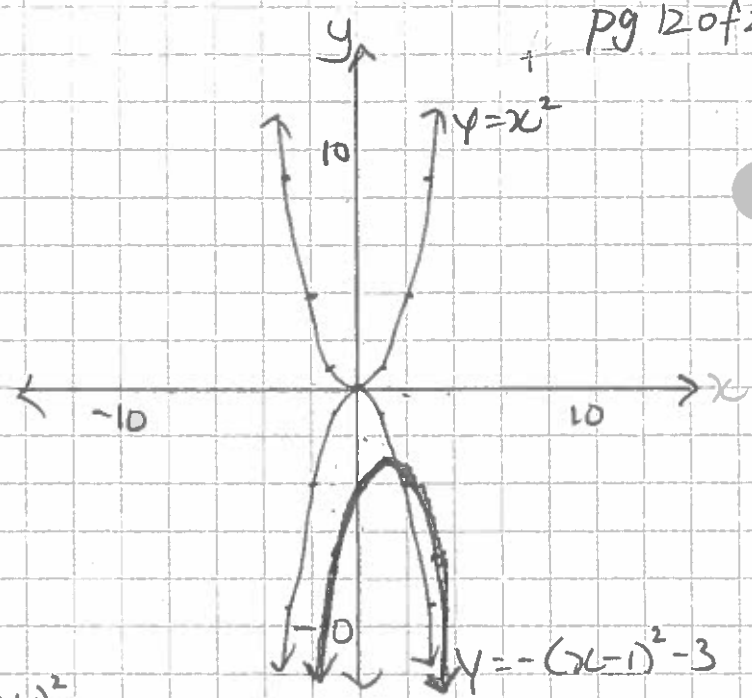
33. (a) $y = 3x^2$
 → vertically stretch by a factor of 3.



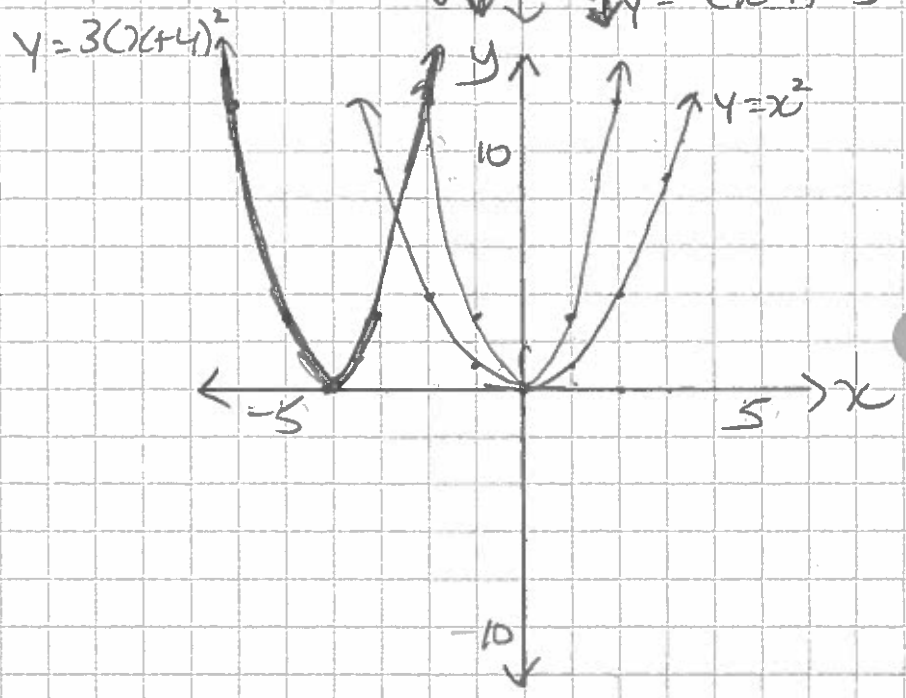
(b) $y = -x^2 + 5$
 → reflect over the x-axis
 → shift up 5 units



33. (c) $y = -(x-1)^2 - 3$
 → reflect over the x-axis
 → shift right 1 unit
 → shift down 3 units

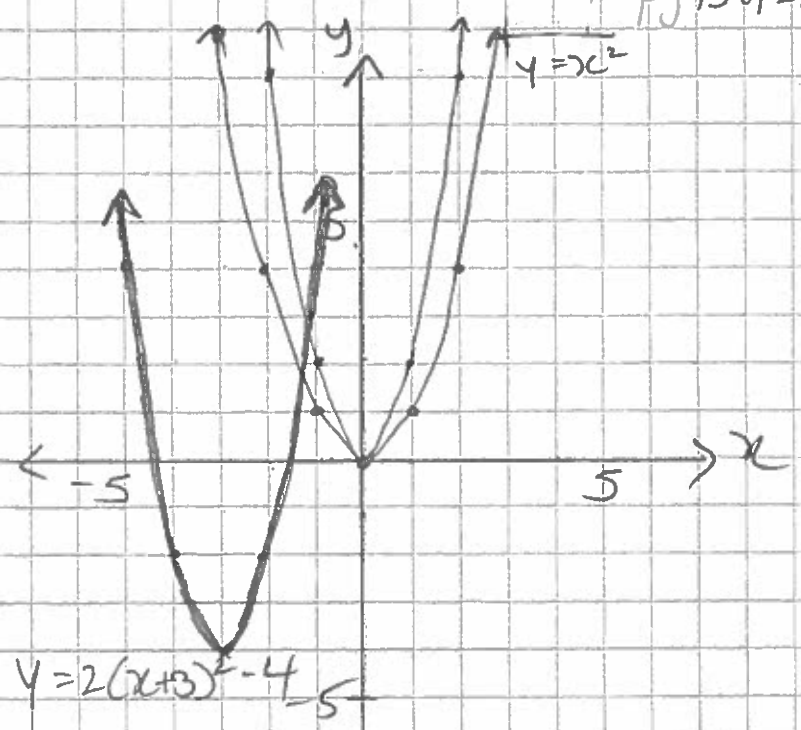


- (d) $y = 3(x+4)^2$
 → vertically stretch by a factor of 3
 → shift left 4 units



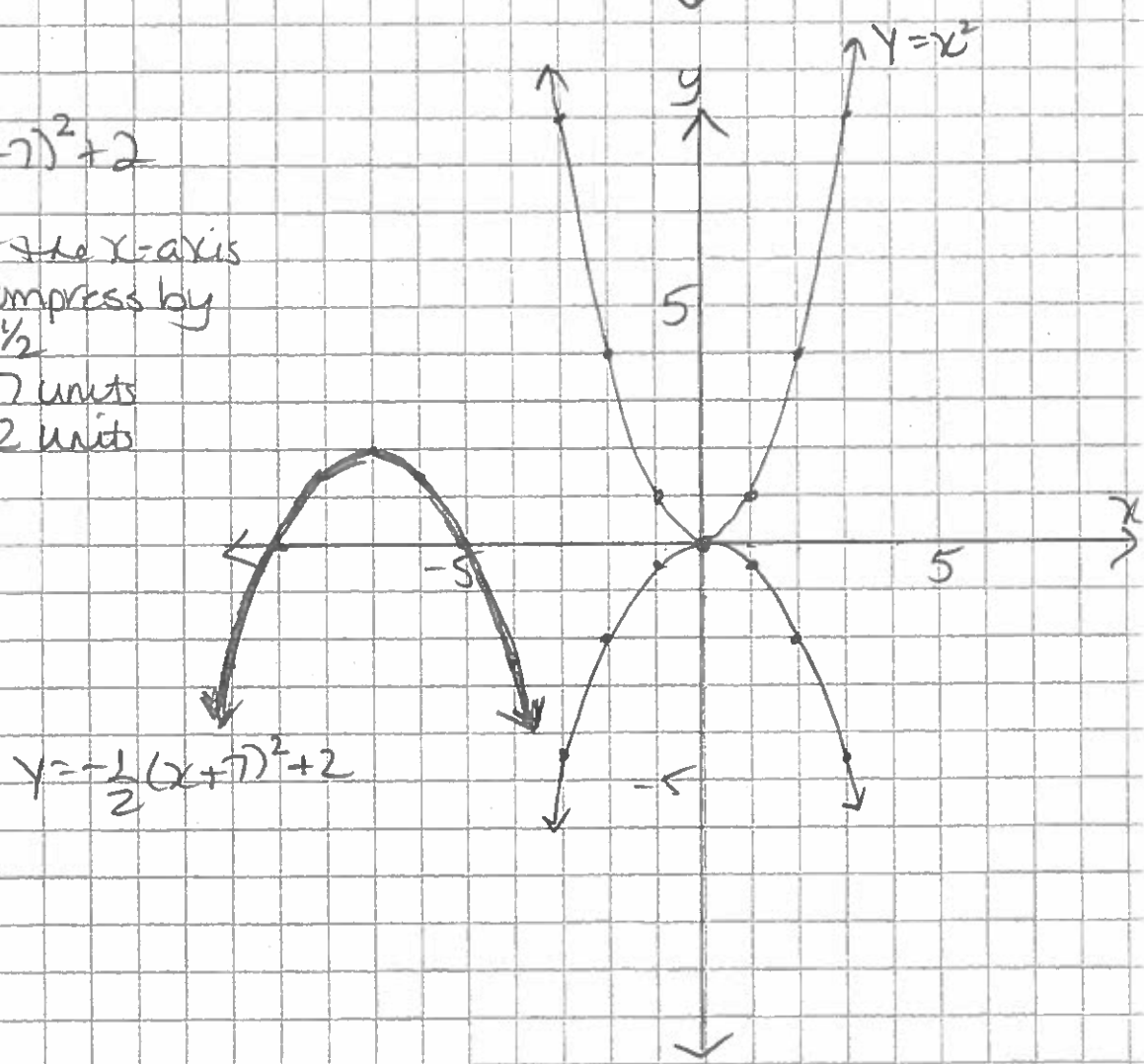
33. (e) $y = 2(x+3)^2 - 4$

- vertically stretch by a factor of 2
- shift left 3 units
- shift down 4 units



(f) $y = -\frac{1}{2}(x+7)^2 + 2$

- reflect over the x-axis
- vertically compress by a factor of 1/2
- shift left 7 units
- shift up 2 units



Unit 6: Solving Quadratic Equations

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34. a) $x^2 - 8x - 9 = 0$ $-\frac{1}{-9}$ $\frac{3}{3}$
 $(x+1)(x-9) = 0$
 $x+1=0$ OR $x-9=0$
 $x=-1$ $x=9$

b) $x^2 + 7x + 6 = 0$ $\frac{1}{6}$ $\frac{2}{3}$
 $(x+1)(x+6) = 0$
 $x+1=0$ OR $x+6=0$
 $x=-1$ $x=-6$

c) $x^2 - 121 = 0$
 $(x+11)(x-11) = 0$
 $x+11=0$ OR $x-11=0$
 $x=-11$ $x=11$

d) $x^2 - 6x + 9 = 0$ $-\frac{3}{3}$
 $(x-3)(x-3) = 0$
 $x-3=0$
 $x=3$

e) $2x^2 + 3x = 0$
 $x(2x+3) = 0$
 $x=0$ OR $2x+3=0$
 $x=-\frac{3}{2}$

f) $4x^2 - 9 = 0$
 $(2x+3)(2x-3) = 0$
 $2x+3=0$ OR $2x-3=0$
 $x=-\frac{3}{2}$ $x=\frac{3}{2}$

g) $3x^2 + 8x - 3 = 0$ $\frac{3}{1}$ $\frac{-1}{3}$
 $(3x-1)(x+3) = 0$
 $3x-1=0$ OR $x+3=0$
 $x=\frac{1}{3}$ $x=-3$

35. a) $x^2 - 4x - 1 = 0$

$$x = \frac{4 \pm \sqrt{(-4)^2 - 4(1)(-1)}}{2(1)}$$

$$= \frac{4 \pm \sqrt{16 + 4}}{2}$$

$$= \frac{4 \pm \sqrt{20}}{2}$$

$$= \frac{4 \pm 4.47}{2}$$

Entweder $x = \frac{4 + 4.47}{2} = \frac{8.47}{2} = 4.24$

oder $x = \frac{4 - 4.47}{2} = \frac{-0.47}{2} = -0.24$

b) $2x^2 - x - 3 = 0$

$$x = \frac{1 \pm \sqrt{(-1)^2 - 4(2)(-3)}}{2(2)}$$

$$= \frac{1 \pm \sqrt{1 + 24}}{4}$$

$$= \frac{1 \pm \sqrt{25}}{4}$$

$$= \frac{1 \pm 5}{4}$$

Entweder $x = \frac{1 + 5}{4} = \frac{6}{4} = 1.5$

oder $x = \frac{1 - 5}{4} = \frac{-4}{4} = -1$

c) $5x^2 - 6x - 2 = 1$

$$5x^2 - 6x - 3 = 0$$

$$x = \frac{6 \pm \sqrt{(-6)^2 - 4(5)(-3)}}{2(5)}$$

$$= \frac{6 \pm \sqrt{36 + 60}}{10}$$

$$= \frac{6 \pm \sqrt{96}}{10}$$

$$= \frac{6 \pm 9.8}{10}$$

Entweder $x = \frac{6 + 9.8}{10} = \frac{15.8}{10} = 1.58$

oder $x = \frac{6 - 9.8}{10} = \frac{-3.8}{10} = -0.38$

d) $m^2 - 5m + 3 = 0$

$$m = \frac{5 \pm \sqrt{(-5)^2 - 4(1)(3)}}{2(1)}$$

$$= \frac{5 \pm \sqrt{25 - 12}}{2}$$

$$= \frac{5 \pm \sqrt{13}}{2}$$

$$= \frac{5 \pm 3.6}{2}$$

Entweder $m = \frac{5 + 3.6}{2} = \frac{8.6}{2} = 4.3$

oder $m = \frac{5 - 3.6}{2} = \frac{1.4}{2} = 0.7$

e) $3w^2 + 8w + 2 = 0$

$$w = \frac{-8 \pm \sqrt{(8)^2 - 4(3)(2)}}{2(3)}$$

$$= \frac{-8 \pm \sqrt{64 - 24}}{6}$$

$$= \frac{-8 \pm \sqrt{40}}{6}$$

$$= \frac{-8 \pm 6.32}{6}$$

Entweder $w = \frac{-8 + 6.32}{6} = \frac{-1.68}{6} = -0.28$

oder $w = \frac{-8 - 6.32}{6} = \frac{-14.32}{6} = -2.39$

f) $-3x^2 + 12x - 7 = 0$

$$x = \frac{-12 \pm \sqrt{(12)^2 - 4(-3)(-7)}}{2(-3)}$$

$$= \frac{-12 \pm \sqrt{144 - 84}}{-6}$$

$$= \frac{-12 \pm \sqrt{60}}{-6}$$

$$= \frac{-12 \pm 7.75}{-6}$$

Entweder $x = \frac{-12 + 7.75}{-6} = \frac{-4.25}{-6} = 0.71$

oder $x = \frac{-12 - 7.75}{-6} = \frac{-19.75}{-6} = 3.29$

Unit 6: Quadratic Word Problems

36. Let x represent the lowest integer

$$x^2 + (x+1)^2 + (x+2)^2 = 194$$

$$x^2 + (x+1)(x+1) + (x+2)(x+2) = 194$$

$$x^2 + x^2 + 2x + 1 + x^2 + 2x + 2x + 4 = 194$$

$$3x^2 + 6x + 5 - 194 = 0$$

$$3x^2 + 6x - 189 = 0$$

$$3(x^2 + 2x - 63) = 0$$

$$x^2 + 2x - 63 = 0$$

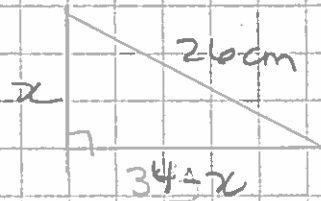
$$(x+9)(x-7) = 0$$

So, $x = -9$ or $x = 7$

When $x = -9$, the integers are $-9, -8, -7$

When $x = 7$, the integers are $7, 8, 9$

37.



Let x represent the length of one side of the triangle. Then $34-x$ represents the other side.

$$x^2 + (34-x)^2 = 26^2$$

$$x^2 + (34-x)(34-x) = 676$$

$$x^2 + 1156 - 34x - 34x + x^2 = 676$$

$$2x^2 - 68x + 480 = 0$$

$$2(x^2 - 34x + 240) = 0$$

$$x^2 - 34x + 240 = 0$$

$$(x-24)(x-10) = 0$$

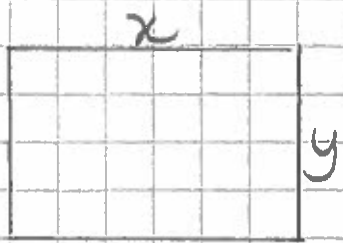
So, $x = 24$ or $x = 10$

When $x = 24$, $34-x \Rightarrow 34-24 = 10$

When $x = 10$, $34-x \Rightarrow 34-10 = 24$

The other sides are 24cm and 10cm

38.



Let x represent one side
Let y represent the other side

$$\begin{aligned} 2x + 2y &= 800 \\ x + y &= 400 \\ y &= 400 - x \end{aligned}$$

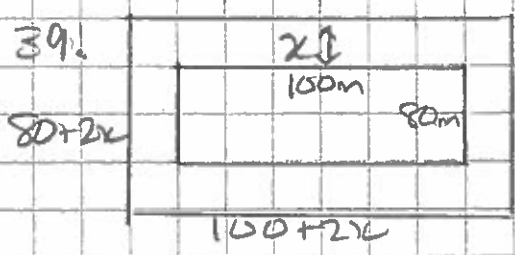
$$\begin{aligned} A &= xy \\ &= x(400 - x) \\ &= 400x - x^2 \\ &= -x^2 + 400x \\ &= -(x^2 - 400x) \\ &= -(x^2 - 400x + 40000 - 40000) \\ &= -(x^2 - 400x + 40000) + 40000 \\ &= -(x - 200)^2 + 40000 \end{aligned}$$

(a) When $x=200$ you get the maximum area
When $x=200$ $y=400-200=200$

'200m x 200m' gives the maximum area

(b) The maximum area is 40000m²

39.



Let x represent the width of the lawn.

$$A_{\text{building}} = 100 \times 80 = 8000$$

$$A_{\text{lawn}} = A_{\text{total}} - A_{\text{building}}$$

$$\begin{aligned} 8000 &= (100 + 2x)(80 + 2x) - 8000 \\ 0 &= 8000 + 200x + 160x + 4x^2 - 8000 - 8000 \\ 0 &= 4x^2 + 360x - 8000 \\ 0 &= 4(x^2 + 90x - 2000) \\ 0 &= x^2 + 90x - 2000 \end{aligned}$$

$$\begin{aligned} x &= \frac{-90 \pm \sqrt{90^2 - 4(1)(-2000)}}{2} \\ &= \frac{-90 \pm \sqrt{8100 + 8000}}{2} \\ &= \frac{-90 \pm \sqrt{16100}}{2} \end{aligned}$$

$$\begin{aligned} x &= \frac{-90 \pm 126.89}{2} \\ x &= \frac{-90 + 126.89}{2} \quad \text{or} \quad x = \frac{-90 - 126.89}{2} \\ &= 18.45 \quad \text{or} \quad = -108.45 \end{aligned}$$

But $x > 0$
The width of the lawn is 18.5m.

40. a) $h = -0.07(d-10)^2 + 8$
 The maximum height of the ball is 8m.

b) The ball is 10m from home plate at the maximum value

c) when $d=0$, $h = -0.07(0-10)^2 + 8$
 $h = -0.07(-10)^2 + 8$
 $h = -7 + 8$
 $h = 1$

∴ the ball was 1m above the ground when it was hit.

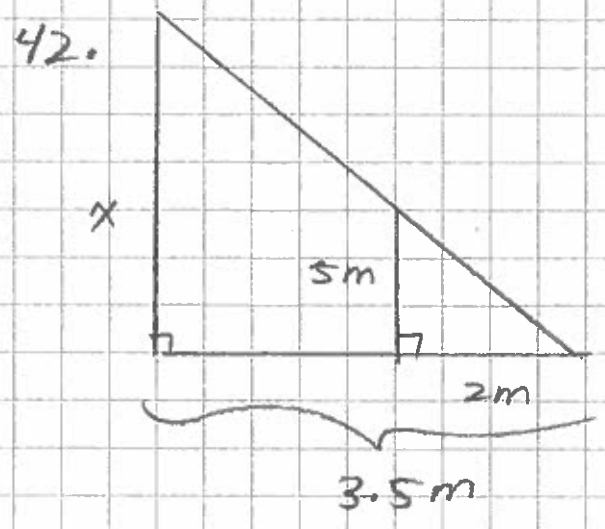
d) When $d = 19.5$, $h = -0.07(19.5-10)^2 + 8$
 $h = -0.07(9.5)^2 + 8$
 $h = -6.3175 + 8$
 $h = 1.6825$

∴ the infielder's glove was 1.7m above the ground.

Unit 7: Congruent and Similar Triangles

41. Scale Factor = $\frac{XY}{ST} = \frac{8}{5} = 1.6$

$SR = 7 \div 1.6 = 4.375 \text{ cm}$
 $WY = 6 \times 1.6 = 9.6 \text{ cm}$

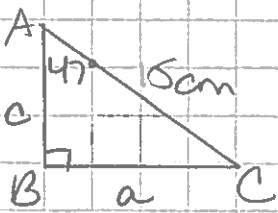


scale factor = $\frac{3.5}{2} = 1.75$

$x = 5 \times 1.75$
 $x = 8.75$

∴ the height of the tree is 8.75m

43. (a)



$$\sin 47^\circ = \frac{a}{15}$$

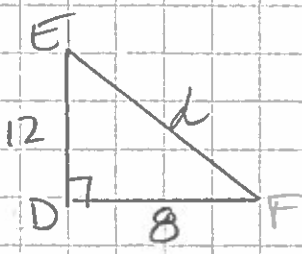
$$a = 15 \sin 47^\circ = 10.9703 \approx 11$$

$$\cos 47^\circ = \frac{c}{15}$$

$$c = 15 \cos 47^\circ = 10.237 \approx 10.2$$

$$\angle C = 180 - 90 - 47 = 43^\circ$$

(b)



$$\tan F = \frac{12}{8}$$

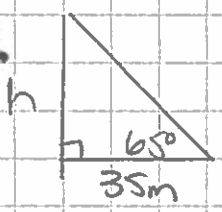
$$\tan F = 1.5 \Rightarrow F = 56^\circ$$

$$d^2 = 12^2 + 8^2 = 144 + 64 = 208$$

$$d = \sqrt{208} \approx 14.4$$

$$\angle E = 180 - 90 - 56 = 34^\circ$$

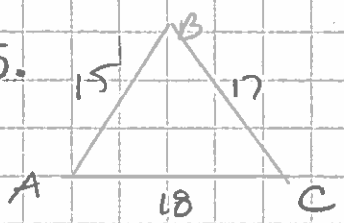
44.



$$\tan 65^\circ = \frac{h}{35} \Rightarrow h = 35 \tan 65^\circ \approx 75.1$$

∴ The building is 75.1m high

45.



largest angle opposite longest side → ∠ B

$$b^2 = a^2 + c^2 - 2ac \cos B$$

$$18^2 = 17^2 + 15^2 - 2(17)(15) \cos B$$

$$324 = 289 + 225 - 510 \cos B$$

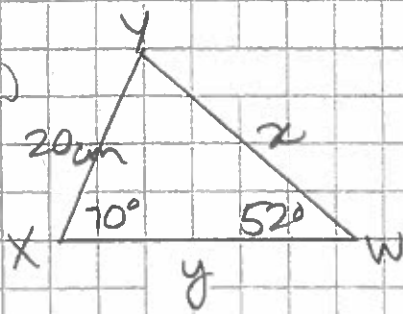
$$-190 = -510 \cos B$$

$$\cos B = 0.3725$$

$$B = 68^\circ$$

∴ The largest angle is 68°

4b. (a)



$$\angle Y = 180 - 70 - 52$$

$$= 58^\circ$$

$$\frac{z}{\sin 70} = \frac{20}{\sin 52}$$

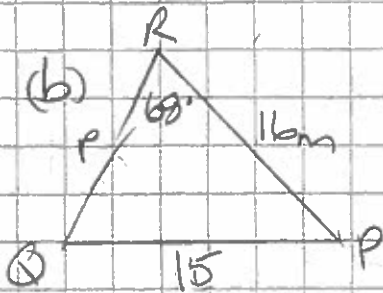
$$z = \frac{20 \sin 70}{\sin 52}$$

$$= 23.8$$

$$\frac{y}{\sin 58} = \frac{20}{\sin 52}$$

$$y = \frac{20 \sin 58}{\sin 52}$$

$$= 21.5$$



$$\sin Q = \frac{\sin R}{r}$$

$$\sin Q = \frac{p \sin R}{r}$$

$$= \frac{16 \sin 68}{15}$$

$$= 0.9890$$

$$Q = \sin^{-1}(0.9890)$$

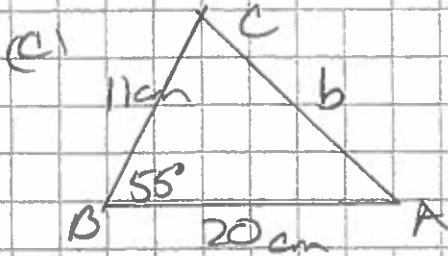
$$Q = 81^\circ$$

$$\angle P = 180 - 68 - 81$$

$$P = 31^\circ$$

$$\frac{p}{\sin P} = \frac{r}{\sin R}$$

$$p = \frac{r \sin P}{\sin R} = \frac{15 \sin 31}{\sin 68} = 8.3$$



$$b^2 = 11^2 + 20^2 - 2(11)(20)\cos 55^\circ$$

$$= 121 + 400 - 440(0.5736)$$

$$= 521 - 252.384$$

$$= 268.616$$

$$b = \sqrt{268.616}$$

$$= 16.4 \text{ cm}$$

$$\frac{\sin A}{11} = \frac{\sin 55}{16.4}$$

$$\sin A = \frac{11 \sin 55}{16.4}$$

$$\frac{11 \sin 55}{16.4}$$

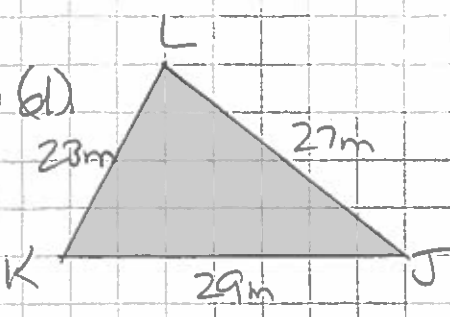
$$\sin A = 0.5494$$

$$A = 33^\circ$$

$$\angle C = 180 - 33 - 55$$

$$= 92^\circ$$

46 b)



$$29^2 = 23^2 + 27^2 - 2(23)(27)\cos L$$

$$841 = 529 + 729 - 1242\cos L$$

$$-417 = -1242\cos L$$

$$\cos L = \frac{-1242}{-1242} = 0.3357$$

$$L = 70^\circ$$

$$\frac{\sin K}{27} = \frac{\sin 70.4}{29}$$

$$\sin K = \frac{27 \sin 70.4}{29}$$

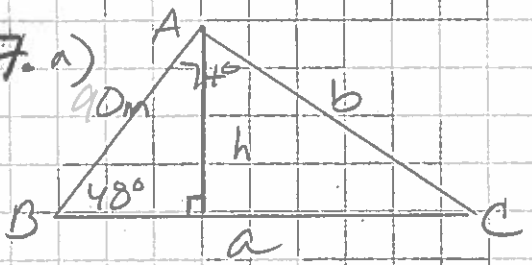
$$\sin K = 0.8771$$

$$K = 61^\circ$$

$$LJ = 180 - 70^\circ - 61^\circ$$

$$J = 49^\circ$$

47 a)



$$LC = 180 - 74 - 48 = 58$$

$$\frac{a}{\sin 74} = \frac{90}{\sin 58}$$

$$a = \frac{90 \sin 74}{\sin 58} = 102.0$$

$$\frac{b}{\sin 48} = \frac{90}{\sin 58}$$

$$b = \frac{90 \sin 48}{\sin 58} = 78.5$$

$$P = 90 + 102 + 78.9$$

$$P = 270.9$$

∴ The perimeter is 270.9m

b)

$$\sin 48 = \frac{h}{90}$$

$$h = 90 \sin 48$$

$$h = 66.9$$

$$A = \frac{b \times h}{2}$$

$$A = \frac{102.0 \times 66.9}{2}$$

$$A = 3411.9 \text{ m}^2$$

