

7.3

#4 a)  $x+7=12$

$x=5$

check ✓

$x+7=-12$

$x=-19$

check ✓

 $\therefore x=5$  or  $x=-19$ 

b)  $|3x-4|=2$

$3x-4=2$

$3x=6$

$x=2$

✓

$3x-4=-2$

$3x=2$

$x=\frac{2}{3}$

✓

 $\therefore x=2$  or  $x=\frac{2}{3}$ 

c)  $2|x+6|+12=-4$

$2|x+6|=-16$

$|x+6|=-8$

 $\therefore$  no solution

d)  $-6|2x-14|=-42$

$|2x-14|=7$

$2x-14=7$

$2x=21$

$x=\frac{21}{2}$

✓

$2x-14=-7$

$2x=7$

$x=\frac{7}{2}$

✓

 $\therefore x=\frac{21}{2}$  or  $x=\frac{7}{2}$ 

5a)  $|2a+7|=a-4$

$2a+7=a-4$

$a=-11$

check:  $15=-15$ 

extraneous.

$-(2a+7)=a-4$

$-2a-7=a-4$

$-3a=3$

$a=-1$

check:  $5=-5$ 

extraneous

 $\therefore$  no solution

b)  $|7+3x|=11-x$

$7+3x=11-x$

$4x=4$

$x=1$

✓

$-7-3x=11-x$

$-2x=18$

$x=-9$

✓

 $\therefore x=1$  or  $x=-9$

$$5c) |1-2m| = m+2$$

$$1-2m = m+2$$

$$-3m = 1$$

$$m = -\frac{1}{3}$$

✓

$$2m-1 = m+2$$

$$m = 3$$

✓

$$\therefore m = 3 \text{ or } m = -\frac{1}{3}$$

$$d) |3x+3| = 2x-5$$

$$3x+3 = 2x-5$$

$$x = -8$$

$$\text{check: } 21 = -21$$

$$-3x-3 = 2x-5$$

$$-5x = -2$$

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

$$2\frac{1}{5} = -2\frac{1}{5}$$

$\therefore$  no solution

$$e) 3|2a+7| = 3a+12$$

$$|2a+7| = a+4$$

$$2a+7 = a+4$$

$$a = -3$$

✓

$$-2a-7 = a+4$$

$$-3a = 11$$

$$a = -\frac{11}{3}$$

✓

$$a = -3 \text{ or } a = -\frac{11}{3}$$

$$6a) |x| = x^2 + x - 3$$

$$x = x^2 + x - 3$$

$$0 = x^2 - 3$$

$$x = \pm\sqrt{3}$$

$$\text{check } x = \sqrt{3}$$

$$\sqrt{3} = 3 + \sqrt{3} - 3 \quad \checkmark$$

$$\text{check } x = -\sqrt{3}$$

$$\sqrt{3} = 3 - \sqrt{3} + 3$$

$$2\sqrt{3} = 2(3) \quad \times$$

$$-x = x^2 + x - 3$$

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

$$0 = (x+3)(x-1)$$

$$x = -3 \quad x = 1$$

$$\text{check } x = -3$$

$$3 = 9 - 3 - 3 \quad \checkmark$$

$$\text{check } x = 1$$

$$1 = 1 + 1 - 3 \quad \times$$

$$\therefore x = \sqrt{3} \text{ or } x = -3$$

$$b) |x^2 - 2x + 2| = 3x - 4$$

$$x^2 - 2x + 2 = 3x - 4$$

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

$$(x-2)(x-3) = 0$$

$$x = 2 \quad x = 3$$

$$-x^2 + 2x - 2 = 3x - 4$$

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

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

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

$$x = 1 \quad x = -2$$

$$6b) |x^2 - 2x + 2| = 3x - 4$$

$$\text{check } x = 2$$

$$2 = 2 \checkmark$$

$$x = 3$$

$$5 = 5 \checkmark$$

$$x = 1$$

$$1 = -1 \times$$

$$x = -2$$

$$10 = -10 \times$$

$$\therefore x = 2 \text{ or } x = -3$$

$$c) |x^2 - 9| = x^2 - 9$$

$$x^2 - 9 = x^2 - 9$$

$$0 = 0$$

for  $x^2 - 9 \geq 0$  all values work

$$x^2 \geq 9$$

$$x \geq 3, x \leq -3$$

$$-x^2 + 9 = x^2 - 9$$

$$18 = 2x^2$$

$$9 = x^2$$

$$x = \pm 3 \checkmark$$

$$\therefore x \leq -3 \text{ or } x \geq 3$$

$$d) |x^2 - 1| = x$$

$$x^2 - 1 = x$$

$$x^2 - x - 1 = 0$$

$$x = \frac{1 \pm \sqrt{1+4}}{2}$$

$$x = \frac{1 + \sqrt{5}}{2}, \frac{1 - \sqrt{5}}{2}$$



↑  
negative

$$\left| \frac{1 + 2\sqrt{5} + 5 - 1}{4} - 1 \right| = \frac{1 + \sqrt{5}}{2}$$

$$\left| \frac{6 + 2\sqrt{5} - 4}{4} \right| =$$

$$\left| \frac{2 + 2\sqrt{5}}{4} \right| =$$

$$\left| \frac{1 + \sqrt{5}}{2} \right| =$$

✓

$$1 - x^2 = x$$

$$0 = x^2 + x - 1$$

$$x = \frac{-1 \pm \sqrt{1+4}}{2}$$

$$x = \frac{-1 + \sqrt{5}}{2}, \frac{-1 - \sqrt{5}}{2}$$



↑  
negative

$$\left| \frac{1 - 2\sqrt{5} + 5}{4} - 1 \right| = \frac{-1 + \sqrt{5}}{2}$$

$$\left| \frac{6 - 2\sqrt{5} - 4}{4} \right| =$$

$$\left| \frac{2 - 2\sqrt{5}}{4} \right| =$$

$$\left| \frac{1 - \sqrt{5}}{2} \right| =$$

$$\frac{\sqrt{5} - 1}{2} = \checkmark$$

$$\therefore x = \frac{1 + \sqrt{5}}{2}, \frac{\sqrt{5} - 1}{2}$$

$$6e) |x^2 - 2x - 16| = 8$$

$$x^2 - 2x - 16 = 8$$

$$x^2 - 2x - 24 = 0$$

$$(x-6)(x+4) = 0$$

$$x=6 \quad x=-4$$

$$x^2 - 2x - 16 = -8$$

$$x^2 - 2x - 8 = 0$$

$$(x-4)(x+2) = 0$$

$$x=4 \quad x=-2$$

$$\text{check } x=6$$

$$8=8 \checkmark$$

$$x=-4$$

$$8=8 \checkmark$$

$$x=4$$

$$8=8 \checkmark$$

$$x=-2$$

$$8=8 \checkmark$$

$$\therefore x = -4, -2, 4, 6$$

$$7a) |d - 18| = 0.5$$

$$b) d = 17.5 \text{ mm to } d = 18.5 \text{ mm}$$

$$8a) |c - 299792456.2| = 1.1$$

$$b) 299792455.1 \text{ to } 299792457.3 \text{ m/s}$$

$$9. a) |v - 50000| = 2000$$

$$b) 48000 \text{ to } 52000 \text{ L}$$

$$10. a) x = 2.2 \quad x = 11.8$$

$$b) |x - 7| = 4.8$$

$$11. a) 64 \pm 2.5 \quad m = 61.5 - 66.5$$

$$69 \pm 2.5 \quad m = 66.5 - 71.5$$

$\therefore$  mass must be 66.5g

$$b) 251 \text{ ml} - 265 \text{ ml}$$

$$12. a) 381550 \pm 25150$$

$$356400 \text{ km}$$

perigee

$$406700 \text{ km}$$

apogee

b) 381550 km is average distance to the moon ( $\pm 25150 \text{ km}$ )

$$13 a) \text{ true for } n \geq 0$$

$$b) \text{ true for } n \leq 0$$

$$14 a) |ax| = b+c$$

$$\text{for } a \geq 0 \quad x = \frac{b+c}{a}$$

$$\text{for } a < 0 \quad x = -\frac{b+c}{a}$$

$$\begin{array}{l} \text{restrictions} \\ b+c > 0 \\ a \neq 0 \end{array}$$

$$14b) |x-b| = c$$

$$\text{for } x \geq b \quad \begin{aligned} x-b &= c \\ x &= b+c \end{aligned}$$

$$\text{for } x < b \quad \begin{aligned} b-x &= c \\ x &= b-c \end{aligned}$$

restriction  
~~into~~  
 $c \geq 0$

15. Erin  $|x-4| = 4$   
 $\downarrow$   
 $x+4 = 4$  is incorrect.

Andrea is correct

16.  $|T-11.5| = 2.5$      min  $9^\circ\text{C}$  max  $14^\circ\text{C}$

17a)  $|x-81| = 16.2$      b) 97.2mg (greater effect?)  
64.8mg to 97.2mg

20. a) -2 and 8     midpt 3      $x = 3 \pm 5$   
 $x-3 = \pm 5$   
 $|x-3| = 5$

b)  $|x \pm a| = -\text{anything}$

c)  $|x \pm a| = 0$

d)  $|x+2| = 1$

22a)  $|x-3| = 4$      b)  $|x^2-4| = 5$