Pre Calc 11
Word Problems - Detailed Key

1. $h = 1 + 20t - 5t^2$

$h = -5t^2 + 20t + 1$

a) $t = 2 \longrightarrow h = -5(2)^2 + 20(2) + 1 = 21$

$\boxed{h = 21\text{m}}$

b) $16 = h \longrightarrow 16 = -5t^2 + 20t + 1$

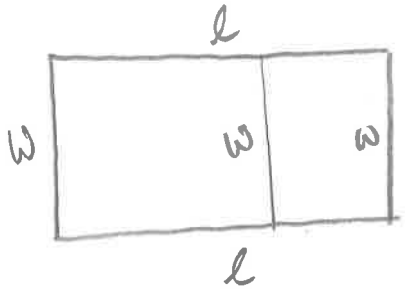
$0 = -5t^2 + 20t - 15$

$0 = t^2 - 4t + 3$

$0 = (t-3)(t-1) \longrightarrow t = 3, 1$

height is 16m at 1s and 3s

2.



$A = 96\text{m}^2$ Area $= \ell \cdot w$

Total fence used $= 48\text{m}$

$96 = \ell \cdot w$

$48 = 3w + 2\ell \Rightarrow \frac{48 - 3w}{2} = \ell$

$\Rightarrow 24 - \frac{3}{2}w = \ell$

2 cont.

$96 = \left(24 - \frac{3}{2}w\right)(w)$

$96 = 24w - 3/2\,w^2$

$\frac{-3}{2}w^2 + 24w - 96 = 0$

$-3w^2 + 48w - 192 = 0$

$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\frac{-48 \pm \sqrt{(48)^2 - 4(-3)(-192)}}{-6}$

$\frac{-48 \pm \sqrt{0}}{-6} = \boxed{8} = w$

$96 = l \cdot w$

$96 = 8l$

$\boxed{12 = l}$

$\boxed{12 = l}$

$\boxed{8 = w}$

3. $h = 26 + 9t - 4.9t^2$

$h = -4.9t^2 + 9t + 26$

a) $h = 20$ $\quad 20 = -4.9t^2 + 9t + 26$

$0 = -4.9t + 9t + 6$

$\frac{-9 \pm \sqrt{(9)^2 - 4(-4.9)(6)}}{2(-4.9)} = \frac{-9 \pm \sqrt{198.6}}{-9.8}$ $\quad \oplus -0.519$ ✗

$\ominus\ 2.356 = \boxed{2.4\text{s}}$

3b) $h = 30$ $\quad 30 = -4.9t^2 + 9t + 26$

$$0 = -4.9t^2 + 9t - 4$$

$$\frac{-9 \pm \sqrt{(9)^2 - 4(-4.9)(-4)}}{2(-4.9)} = \frac{-9 \pm \sqrt{2.6}}{-9.8} = \begin{array}{l} (+)\ .753 = \boxed{.8s} \\ (-)\ 1.082 = \boxed{1.1s} \end{array}$$

3c) Because the bridge is 26m above the river, so it will only ever fall through 20m once, but will pass through 30m as it is thrown up, <u>and</u> falls.

4) $d = 23t - .6t^2 \quad \Rightarrow \quad -.6t^2 + 23t = d$

$d = 60 \longrightarrow \quad -.6t^2 + 23t = 60$

$$-.6t^2 + 23t - 60 = 0$$

$$\frac{-23 \pm \sqrt{(23)^2 - 4(-.6)(-60)}}{2(-.6)} = \frac{-23 \pm \sqrt{385}}{-1.2}$$

$$= \begin{array}{l} (+)\ \boxed{2.8s} \\ (-)\ 35.5 \times \end{array}$$

As the car only decelerated for 15s

5. let x be one #
let y be the other #.

① $x - y = 6$

$x = 6 + y$

$x = 6 + y$

$x = 6 + (-3)$

$\boxed{x = 3}$

② $xy = M$

$(6+y)(y) = M$

$6y + y^2 = M$

$y^2 + 6y = M$

$b = 6 \quad \left(\frac{b}{2}\right)^2 = 9$

$y^2 + 6y + 9 = M + 9$

$(y+3)^2 = M + 9$

$M = (y+3)^2 - 9$

$\boxed{y = -3}$

6. let ℓ be one dimension (length)
let w be the other (width)

$\ell + w = 20$

$w = 20 - \ell$

$w = 20 - 10$

$\boxed{w = 10\text{m}}$

$\ell \times w = A$

$(\ell)(20 - \ell) = A$

$20\ell - \ell^2 = A$

$-\ell^2 + 20\ell = A$

$-\ell^2 + 20\ell + 100 = A + 100$

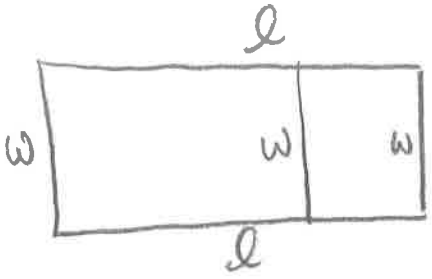
$b = 20 \quad \left(\frac{b}{2}\right)^2 = 100$

$-(\ell - 10)^2 = A + 100$

$-(\ell - 10)^2 - 100 = A$

$\boxed{\ell = 10\text{cm}}$

7.



$2l + 3w = 450$

$l \times w = A$

$3w = 450 - 2l$

$w = 150 - \frac{2}{3}l$

$l(150 - \frac{2}{3}l) = A$

$150l - \frac{2}{3}l^2 = A$

$-\frac{2}{3}l^2 + 150l = A$

$-225 = b$

$-\frac{2}{3}(l^2 - 225) = A$

$(\frac{b}{2})^2 = 12656.25$

$-\frac{2}{3}(l^2 - 225 + 12656.25) = A + 12656.25$

$-\frac{2}{3}(l - 112.5)^2 - 12656.25 = A$

$l = 112.5\text{m}$

$w = 150 - \frac{2}{3}(112.5)$

$w = 75\text{m}$

8. Price = \$75 For every \$5 ↑, -50 sold

Base Sales = 1000 Let x be the # of increments

- Revenue = Price × Sales

$$R = (75 + 5x)(1000 - 50x)$$

$$R = 75000 - 3750x + 5000x - 250x^2$$

$$R = -250x^2 + 1250x + 75000$$

$$R = x^2 - 5x - 300$$

$b = 5$

$\left(\frac{b}{2}\right)^2 = \frac{25}{4}$

$$R + 300 = x^2 - 5x$$

$$R + 300 + \frac{25}{4} = x^2 - 5x + \frac{25}{4}$$

$$R + 306.25 = \left(x - \frac{5}{2}\right)^2$$

$$R = \left(x - \frac{5}{2}\right)^2 - 306.25$$

$$x = \frac{5}{2} = 2.5$$

$$\text{Price} = 75 + 5(2.5) = \boxed{\$87.5}$$

9. let x be one number
let y be the other

$x+y=36$ $\qquad$ $xy=M$

$y=36-x$ $\qquad$ $(x)(36-x)=M$

$36x-x^2=M$

$-x^2+36x=M$ $\qquad$ $b=36$

$\left(\frac{b}{2}\right)^2=324$

$-x^2+36x+324=M+324$

$-(x-18)^2=M+324$

$-(x-18)^2-324=M$

$x=18$

$y=36-(18)$

$y=18$

10. ① $y=-.096(x-25)^2+60$

② $8x-10y=-15 \Rightarrow 10y=8x+15 \Rightarrow y=\frac{4}{5}x+\frac{3}{2}$

$\frac{4}{5}x+\frac{3}{2}=-.096(x-25)^2+60$

$800x+1500=-96(x-25)^2+60000$

10. Cont.

$$800x = -96(x-25)^2 + 58500$$

$$-8\tfrac{1}{3}x = (x-25)^2 - 609\tfrac{3}{8}$$

$$0 = 8\tfrac{1}{3}x + x^2 - 50x + 625 - 609\tfrac{3}{8}$$

$$0 = x^2 - 41\tfrac{2}{3}x + 15\tfrac{5}{8}$$

$$0 = \frac{41\frac{2}{3} \pm \sqrt{\left(41\frac{2}{3}\right)^2 - 4(1)\left(15\frac{5}{8}\right)}}{2(1)}$$

$$= \frac{41\frac{2}{3} \pm 40.9}{2}$$

$\oplus$ $41.28 = \boxed{41.3} = x_1$

$\ominus$ $.38\overline{3} = \boxed{.4} = x_2$

$x_1 \rightarrow$ $y_1 = \frac{4}{5}(41.3) + \frac{3}{2}$

$y_1 = 34.54$

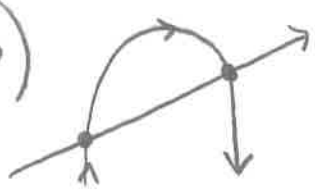
$\boxed{(41.3, 34.5)}$

$x_2 \rightarrow$ $y_2 = \frac{4}{5}(.4) + \frac{3}{2}$

$y_2 = 1.82$

$\boxed{(.4, 1.8)}$

10b)



The telescope will have the flare in its sight at the given coordinates.

11. ① $-4.9t^2 - 10t + 50 = h$

② $-4.9t^2 + 15t = h$

a) $-4.9t^2 - 10t + 50 = -4.9t^2 + 15t$

$-10t + 50 = 15t$

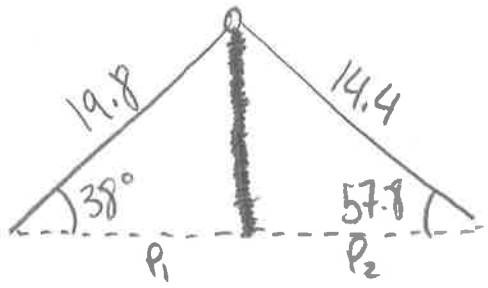
$50 = 25t$

$\boxed{t = 2 \text{ sec}}$

b) $-4.9(2)^2 + 15(2) = h$

$\boxed{h = 10.4 \text{ m}}$

12.



$\cos = \frac{A}{H}$

$P_1 = \cos 38 = \frac{A}{19.8}$

$P_1 = 19.8 \cos 38$

$P_1 = 15.6\text{m}$

$P_2 = \cos 57.8 = \frac{A}{14.4}$

$P_2 = 14.4 \cos 57.8$

$P_2 = 7.67$

$P_1 + P_2 = 23.27 = \boxed{23.3\text{m}}$

13. Let J = Jenny's time N = Son's time

$$\frac{1}{5} + \frac{1}{N} = \frac{1}{3}$$

$$\frac{1}{N} = \frac{1}{3} - \frac{1}{5}$$

$$\frac{1}{N} = \frac{2}{15} \Rightarrow N = \frac{15}{2} = \boxed{7.5 \text{ hrs}}$$

14. upstream = 4km per time

downstream = 10km per time

Current = 3 km/h

let x be the speed of the boat.

$$\frac{4}{x-3} = \frac{10}{x+3}$$

$$4(x+3) = 10(x-3)$$

$$4x + 12 = 10x - 30$$

$$42 = 6x$$

$$\boxed{7 = x}$$

15.

let A = Speed of airplane
let C = Speed of Car.

D ⇒ 1000km
S ⇒ A = 10c
T ⇒

	Car	Airplane
Distance:	1000	1000
Speed:	c	A = 10c
Time:	+18	

time of Car − time of airplane = 18 hours

$$\frac{1000}{c} - \frac{1000}{10c} = 18$$

$$10000c - 1000c = 18(c)(10c)$$

$$9000c = 180c^2$$

$$180c^2 - 9000c = 0$$

$$c^2 - 50c = 0$$

$$c(c-50) = 0$$

$c = 0$, $\boxed{50}$ km/h

$A = 10(50)$

$\boxed{A = 500 km/h}$

16. let w = Speed of walking

let B = Speed of biking

	Walk	bike
Distance	6 km	6 km
Speed	w	$4w = B$
Time		

90 mins total ↳ 1.5 hours

$$\frac{6}{w} + \frac{6}{4w} = 1.5$$

$$24w + 6w = 1.5(w)(4w)$$

$$30w = 6w^2$$

$$0 = 6w^2 - 30w$$

$$0 = w^2 - 5w$$

$$0 = w(w-5)$$

$w = 0$ (×), $\boxed{5}$ km/h

$4(5) = B$

$\boxed{20 \text{ km/h} = B}$

17. let H be Henry's speed

let B be Brandon's speed

	Henry	Brendon
Distance	10	10
Speed	$H = B+1$	B
Time		+2 hours $= \frac{1}{30}$

$$\frac{10}{B} - \frac{10}{B+1} = \frac{1}{30}$$

$$(B+1)(10) - 10(B) = \frac{1}{30}(B)(B+1)$$

17 cont.

$$10B + 10 - 10B = \frac{B^2 + B}{30}$$

$$10 = \frac{B^2 + B}{30}$$

$$300 = B^2 + B \Rightarrow B^2 + B - 300 = 0$$

$$B = \frac{-1 \pm \sqrt{1^2 - 4(1)(-300)}}{2(1)}$$

$B = 16.8$ km/h

$H = B + 1$

$H = 16.8 + 1$

$H = 17.8$ km/h

10

	A	B
Distance	56	24
Speed	$x + 8$	$x - 8$
Time	SAME	

let x = the speed of the boats in still water

$$\frac{56}{x+8} = \frac{24}{x-8}$$

$$56(x-8) = 24(x+8)$$

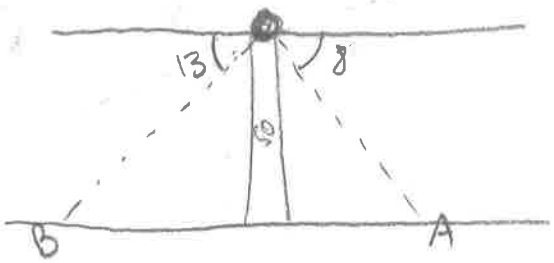
$$56x - 448 = 24x + 192$$

$$32x = 640$$

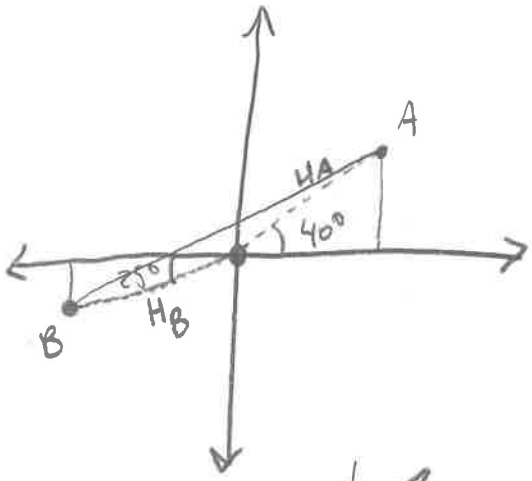
$x = 20$ km/h

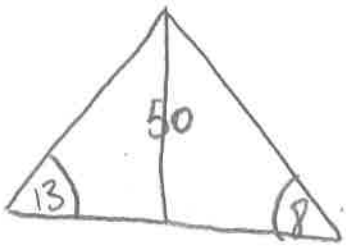
19

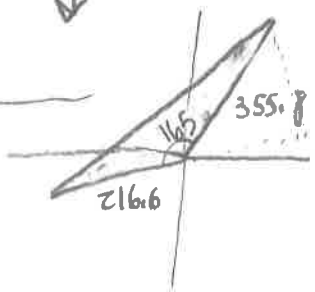
Depression



Bearings







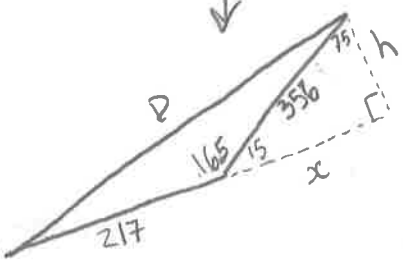
$\tan = \frac{O}{A}$

$\tan 13 = \frac{50}{H_B}$

$H_B = 216.57$

$\tan 8 = \frac{50}{H_A}$

$H_A = 355.77$



$\sin 15 = \frac{h}{356}$

$356 \sin 15 = h$

$h = 92.13$

$\cos 15 = \frac{x}{356}$

$356 \cos 15 = x$

$x = 343.87$

$D^2 = (217 + 344)^2 + (92.13)^2$

$D^2 = 314721 + 8488$

$D = 568.5 \rightarrow$ 568m ← due to continual round-ups.