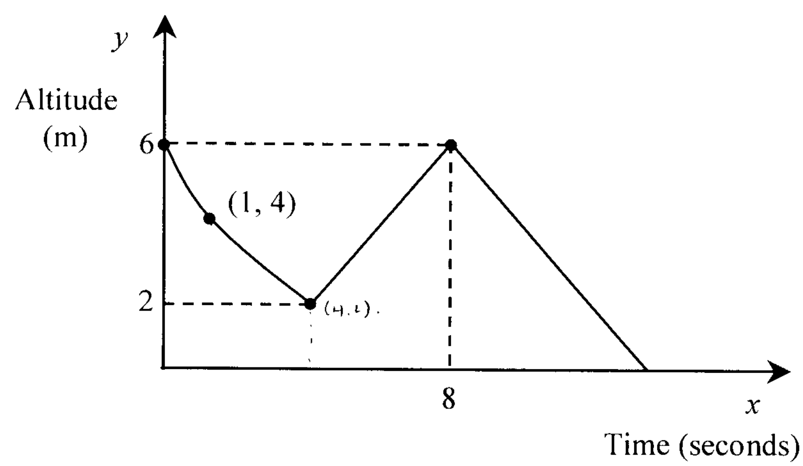
Name : ✱ SOLUTIONS

Date : MAY

ABSOLUTE VALUE: PRACTICE PROBLEMS….PRETEST

1 Anthony received a remote-controlled airplane for his birthday. The plane's altitude, as a function of time, is represented by a square root function followed by an absolute value function. The plane's altitude follows a square root function until it first reaches 2 metres, at which point the altitude can be described by an absolute value function.

Anthony begins by putting his plane into take-off position from an altitude of 6 metres. One second after take-off, the plane is 4 metres above the ground. The plane reaches its maximum altitude of 6 metres 8 seconds after take-off.



How much time did the plane spend in the air?

① $y = a\sqrt{x-h} + k$.

$4 = a\sqrt{1-0} + 6$.

$a = -2$.

if $y = 2$.

$2 = -2\sqrt{x} + 6$

$x = 4$.

$(4,2)$.

② $2 = a|4-8| + 6$

$a = -1$

$y = 0$.

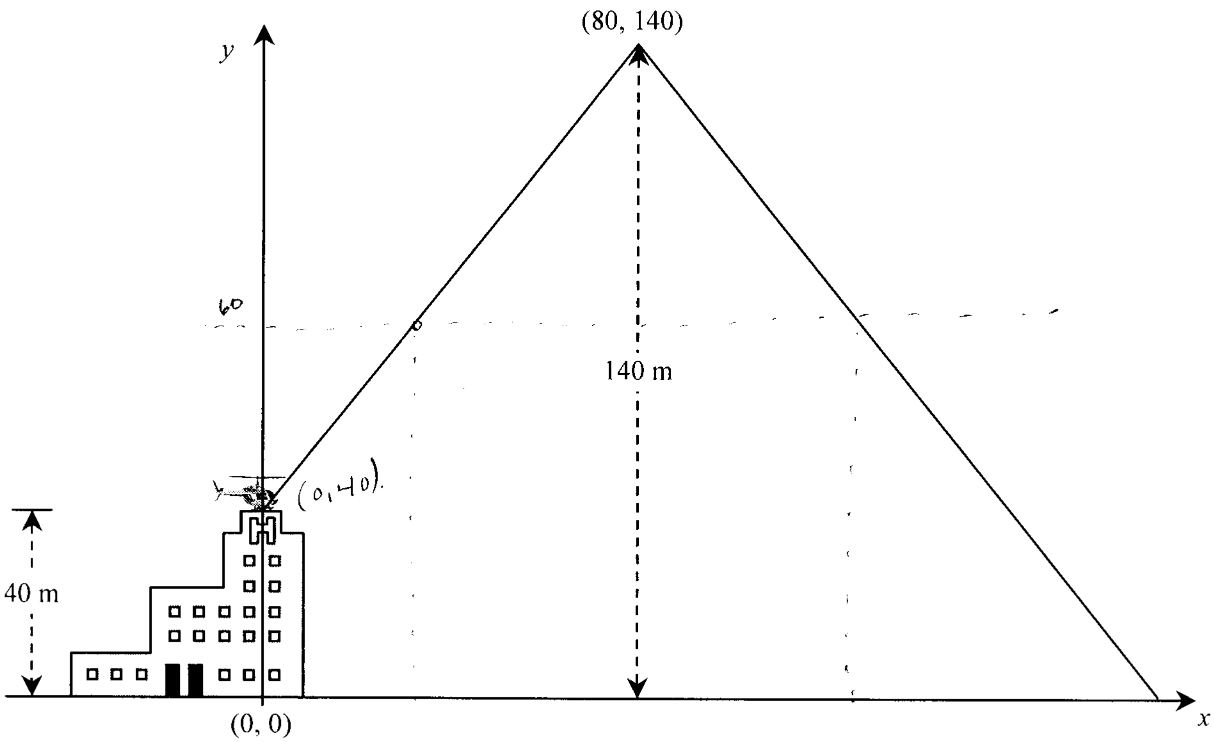
$0 = -1|x-8| + 6$

$6 = |x-8|$

$x = 2$ or $x = 14$

$\therefore$ 14 sec

2 During an emergency flight, a helicopter left the roof of a 40-metre tall hospital. The helicopter flew at a constant speed and reached a maximum height of 140 meters after 80 seconds. Then, the helicopter descended to the ground at the same speed as it had ascended. The helicopter's flight can be represented by an absolute value function.



After how many seconds was the helicopter at an altitude of 60 m during its ascent and descent?

Show all your work.

① rate Δ left: $\frac{140-40}{80-0} = \frac{5}{4}$

$\therefore$ right: $-\frac{5}{4}$

② $h(t) = -\frac{5}{4}|t-80|+140.$

$60 = -\frac{5}{4}|t-80|+140.$

$|t-80| = 64.$

③ $t-80 \geq 0$

$t-80=64$

$t=144$

$t-80<0$

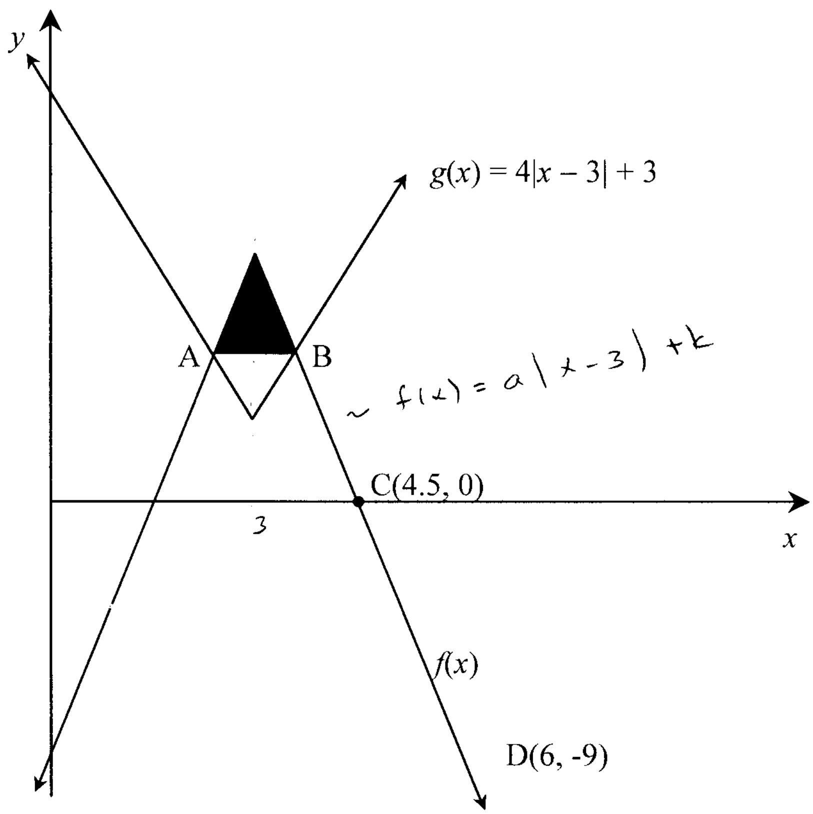
$-t+80=64$

$t=16.$

3 The logo below was created using two absolute value functions represented by $f(x)$ and $g(x)$. The logo has an axis of symmetry passing through the vertices of $f(x)$ and $g(x)$.

$$g(x) = 4|x-3| + 3$$

Points A and B represent the points of intersection between $f(x)$ and $g(x)$. Point C(4.5, 0) is one of the zeros of $f(x)$ and $f(x)$ passes through point D(6, -9).



What is the area of the shaded triangular region in the logo?

Show all your work.

① slope = a = f(x): right

$\frac{-9-0}{6-4.5} = -6$

② $f(x) = -6|x-3| + k$.

$0 = -6|4.5-3| + k$.

$f(x) = -6|x-3| + 9$.

$k = 9$

③ eq'n left say f(x)

$f(0) = -6|0-3| + 9$.

$= -9$

$y = 6x - 9$

eq'n left of g(x).

$g(0) = 4|0-3| + 3$.

$= 15$.

$y = -4x + 15$.

∴ coord. intersection.

$6x - 9 = -4x + 15$.

$x = 2.4;\ y = 5.4$

∴ $x = 3.6;\ 5.4$.

④ area Δ

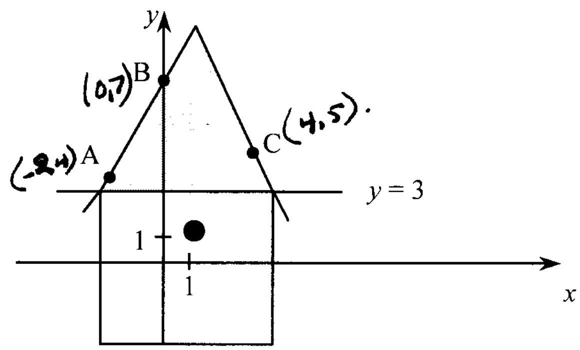
$\frac{b \times h}{2}$

$= \frac{(3.6 - 2.4)\cdot(9 - 5.4)}{2}$

$= 2.16$ units²

4 Ethan's diagram, not drawn to scale, shows the front of a birdhouse. The base of the roof corresponds to the line $y = 3$.

The sides of the roof form an absolute value function that passes through the points A(-2, 4), B(0, 7) and C(4, 5).



What is the area of the shaded triangular section of the front of the birdhouse?

Show all your work.

① slope of left ray:

$$\frac{7-4}{0-(-2)} = \frac{3}{2}$$

∴ eq'n of line:

$$y = \frac{3}{2}x + 7$$

② slope of right ray: $-\frac{3}{2}$

eq'n of right ray

$$y = -\frac{3}{2}x + b$$

$$5 = -\frac{3}{2}(4) + b$$

$$b = 1$$

$$\therefore y = -\frac{3}{2}x + 11$$

③ Vertex of 2 lines

$$\frac{3}{2}x + 7 = -\frac{3}{2}x + 11$$

$$x = 4/3$$

$$\therefore y = \frac{3}{2}\left(\frac{4}{3}\right) + 7$$

$$y = 9$$

④ use

$$y = a|x-h| + k$$

$$y = -\frac{3}{2}\left|x - \frac{4}{3}\right| + 9$$

$V = \left(\frac{4}{3}, 9\right)$ + altitude = $9 - 3 = 6$

⑤ ∴

$$-\frac{3}{2}\left|x - \frac{4}{3}\right| + 9 = 3$$

$$\therefore \left|x - \frac{4}{3}\right| = 4$$

and $x - \frac{4}{3} = 4$, $x = \frac{16}{3}$

and $-x + \frac{4}{3} = 4$, $x = -\frac{8}{3}$

so base length is

$$\frac{16}{3} - \left(-\frac{8}{3}\right) = 8$$

and AREA: $\frac{1}{2}(6)(8) = 24$ units^2