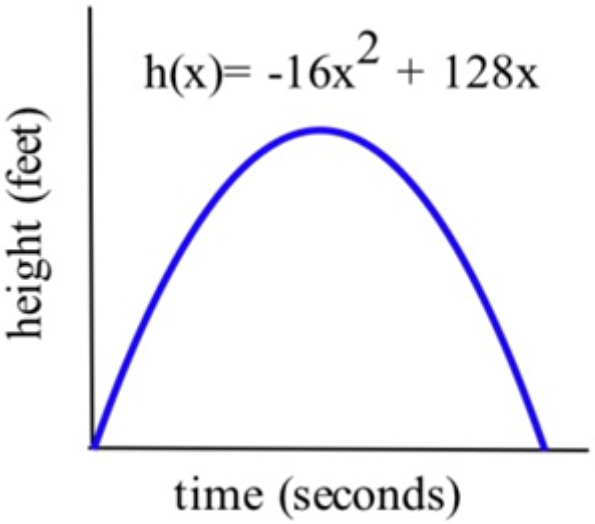
An arrow shot straight up from ground level with an initial velocity of 128 feet per second will be at height $h(t) = -16t^2 + 128t$ feet at t seconds.



1. What is the velocity $v(t)$ of the arrow at any time?
2. At what time t will the velocity of the arrow be 0?
3. What is the greatest height the arrow reaches?
4. How long will the arrow be aloft?
5. What is the acceleration $a(t)$ of the arrow at any time?

In [7]:
```
import sympy as sp
from IPython.display import display

# Define the variable
t = sp.symbols('t')
v = sp.symbols('v', cls=sp.Function)
a = sp.symbols('a', cls=sp.Function)

# Define the height function
h = -16*t**2 + 128*t

# 1.
dh = sp.diff(h, t)
print("1. Velocity function is:")
display(sp.Eq(v(t),dh))

# 2.
time_velocity_zero = sp.solve(dh, t)[0]
print("2. Time when velocity is 0:")
display(time_velocity_zero)

# 3
greatest_height = h.subs(t, time_velocity_zero)
print("3. Greatest height Time at which greatest height occurs")
display(greatest_height)

# 4.
time_alight = sp.solve(h, t)
print("4. Time aloft:")
display(time_alight[1]-time_alight[0])
```

```
# 5.
dhh = sp.diff(dh, t)
print("5. Acceleration function is:")
display(sp.Eq(a(t),dhh))
```

1. Velocity function is:

$v(t) = 128 - 32t$

2. Time when velocity is 0:

4

3. Greatest height Time at which greatest height occurs

256

4. Time aloft:

8

5. Acceleration function is:

$a(t) = -32$

In [ ]: