```
T, F_f, m_1, m_2, a, g = var("T F_f m_1 m_2 a g")

w_1, w_2, b = var("w_1 w_2 b")
m_1 = (w_1 + b)
m_2 = (w_2 + b)

a_1 = 2*a
a_2 = a

eqn1 = solve((T+3*F_f)-m_1*g == -m_1*a_1, T)
eqn2 = solve(2*T-m_2*g == m_2*a_2, T)
eqn = (eqn1[0].rhs() == eqn2[0].rhs())
eqn
```

```
Launched html viewer for Graphics3d Object
```

1 | **For Bucket**

```
solution_b = solve(eqn, b)
solution_b

b_a(a, w_1, w_2, g) = solution_b[0].rhs()
b_1=b_a(0.690271, 0.3, 0.2, 9.81) # group 1, trial 2
b_2=b_a(0.095733, 0.2, 0.2, 9.81) # group 2, trial 2
(b_1, b_2)
b_a
solve([b==b_1, b==b_2], (b, F_f))
```

We will also take the partial derivatives with respect to each variable, and square them, in order to be able to propergate error

Error by acceleration:

```
d_a = var("d_a")
bucket_accel_error = b_a.diff(a)*d_a
bucket_accel_error
```

Error by mass w_1:

```
d_w1 = var("d_w1")
bucket_w1_error = b_a.diff(w_1)*d_w1
bucket_w1_error
```

Error by mass w_2:

```
d_w2 = var("d_w2")
bucket_w2_error = b_a.diff(w_2)*d_w2
bucket_w2_error
```

Total error:

```
bucket_error(a, w_1, w_2, g, d_a, d_w1, d_w2, F_f) = sqrt(bucket_accel_error^2 + bucket_w1_error^2 + bu
# b_1=b_a(0.690271, 0.3, 0.2, 9.81) # group 1, trial 2
# b_2=b_a(0.095733, 0.2, 0.2, 9.81) # group 2, trial 2

bucket_error(0.095733, 0.2, 0.2, 9.81, 0.05, 0.05, 0.05, 2621936548881/2972690000000)
```

2 | **For Friction**

```
solution_f = solve(eqn, F_f)
solution_f

ff_a(a, w_1, w_2, g) = solution_f[0].rhs()
ff_1=ff_a(0.690271, 0.3, 0.2, 9.81) # group 1, trial 1
ff_2=ff_a(0.095733, 0.2, 0.2, 9.81) # group 2, trial 1
(ff_1, ff_2)

solve([F_f==ff_1, F_f==ff_2], (b, F_f))
```

We will also take the partial derivatives with respect to each variable, and square them, in order to be able to propergate error

Error by acceleration:

```
da = var("d_a")
friction_accel_error = ff_a.diff(a)*da
friction_accel_error
```

Error by mass w_1:

```
d_w1 = var("d_w1")
friction_w1_error = ff_a.diff(w_1)*d_w1
friction_w1_error
```

Error by mass w_2:

```
d_w2 = var("d_w2")
friction_w2_error = ff_a.diff(w_2)*d_w2
friction_w2_error
```

Total error:

```
friction_error(a, w_1, w_2, g, d_a, d_w1, d_w2, b) = sqrt(friction_accel_error^2 + friction_w1_error^2 +
friction_error(0.095733, 0.2, 0.2, 9.81, 0.05, 0.05, 0.05, 2728384/7431725)
# friction_error
```