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(%i1) kill(all)$ ratprint:false$ stardisp:true$
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2/19/2016 ore bucket statics problem
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Variable definitions:
m: mass of bucket and ore
W: weight of bucket and ore
Wpar: component of W parallel to rail
Wperp: component of W perpendicular to rail
g: acceleration due to gravity
theta: the angle of the rail
phi: the angle of the cable
alpha: angle between rail and cable
T: tension in cable
Tpar: component of T parallel to rail
Tperp: component of T perpendicular to rail
fA: force of rail acting on roller A
fD: force of rail acting on roller D
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```
(%i3) g:9.8$ m:1590$ W=W:m*g;

      d2r:%pi/180$
      theta: 20*d2r$ phi: 8*d2r$ alpha: theta-phi$

      Tpar: T*cos(alpha)$
      Tperp: T*sin(alpha)$

      Wpar=Wpar: float(W*sin(theta));
      Wperp=Wperp: float(W*cos(theta));

(%o5) W=15582.0
(%o12) Wpar=5329.357873300571
(%o13) Wperp=14642.29041708603
```

```
Sum of all forces acting on bucket parallel to the rail must be zero.
Set 0 = -Wpar +Tpar, and solve for T:
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```
(%i14) simp:false$ z: 0 = -Wpar +Tpar; simp:true$
      T=T: rhs(float(solve(z,T)[1]));
      'Tpar=Tpar:float(''Tpar);
      'Tperp=Tperp:float(''Tperp);
```

```
(%o15) 0=-5329.357873300571+cos( $\frac{\pi}{15}$ )*T
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```
(%o17) T=5448.418898438742
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(%o18) Tpar=5329.35787330058
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(%o19) Tperp=1132.789985457833
```

Sum of torques around point A must be zero.
Set $0 = -Wpar*1.2 + fD*1.5 + Tpar*0.8 + Tperp*1.5$
and solve for fD:

```
(%i20) simp:false$ z: 0 = -(Wpar*1.2) +fD*1.5 +Tpar*0.8 +Tperp*1.5; simp:true$
      fD=fD: float(rhs(solve(z,fD)[1]));
```

```
(%o21) 0=-5329.357873300571*1.2+fD*1.5+5329.35787330058*0.8+1132.789985457833*1.5
```

```
(%o23) fD=288.3721140889809
```

Sum of all forces acting on bucket
perpendicular to the rail must be zero.
Set $0 = -Wperp + fA - fD - Tperp$
and solve for fA:

```
(%i24) simp:false$ z: 0 = - Wperp +fA -fD -Tperp; simp:true$
      fA=float(rhs(solve(z,fA)[1]));
```

```
(%o25) 0=-14642.29041708603+fA-288.3721140889809-1132.789985457833
```

```
(%o27) fA=16063.45251663284
```