```
> restart;
> with(inttrans):
> Qs:=x->Rs*exp(-abs(x)/0.14);
```

$$Qs := x \rightarrow Rs\, e^{-\frac{|x|}{0.14}} \tag{1}$$

```
> minusgradQs:=unapply(-diff(Qs(x),x),x);
```

$$minusgradQs := x \rightarrow 7.142857143\ Rs\ \mathrm{abs}(1, x)\ e^{-7.142857143\ |x|} \tag{2}$$

```
> Qg:=x->Rg*exp(-abs(x)/0.04)-Ag*exp(-abs(x)/0.14);
```

$$Qg := x \rightarrow Rg\, e^{-\frac{|x|}{0.04}} - Ag\, e^{-\frac{|x|}{0.14}} \tag{3}$$

```
> minusgradQg:=unapply(-diff(Qg(x),x),x);
```

$$minusgradQg := x \rightarrow 25.00000000\ Rg\ \mathrm{abs}(1, x)\ e^{-25.00000000\ |x|} - 7.142857143\ Ag\ \mathrm{abs}(1, x)\ e^{-7.142857143\ |x|} \tag{4}$$

```
> rho:=x->Heaviside(x)*8;
```

$$\rho := x \rightarrow 8\ \mathrm{Heaviside}(x) \tag{5}$$

```
> # For solitary locust
> #Note 6 cm/s = 216 m/hr
> vs:=unapply(simplify(int(minusgradQs(x-y)*rho(y),y=-infinity..
  infinity)),x);
```

$$vs := x \rightarrow piecewise\left(x \le 0., -7.999999999\ Rs\, e^{7.142857143\, x}, 0. < x, -7.999999999\ Rs\, e^{-7.142857143\, x}\right) \tag{6}$$

```
> solve(-216=vs(0),Rs);
```

$$27.00000000 \tag{7}$$

```
>
> # For gregarious locust
> # Note 6 cm/s = 216 m/hr and 2 cm/s = 72 m/hr
> vg1:=unapply(simplify(int(minusgradQg(x-y)*rho(y),y=-infinity..
  infinity)),x);
```

$$vg1 := x \rightarrow piecewise\left(x \le 0., -8.\ Rg\, e^{25.\, x} + 8.\ Ag\, e^{7.142857143\, x}, 0. < x, -8.\ Rg\, e^{-25.\, x} + 8.\ Ag\, e^{-7.142857143\, x}\right) \tag{8}$$

```
> rho2:=x->8*Heaviside(x-0.14);
```

$$\rho 2 := x \rightarrow 8\ \mathrm{Heaviside}(x - 0.14) \tag{9}$$

```
> vg2:=unapply(simplify(int(minusgradQg(x-y)*rho2(y),y=-infinity..
  infinity)),x);
```

$$vg2 := x \rightarrow piecewise\left(x \le 0.1400000000, -8.\ Rg\, e^{25.\, x - 3.500000000} + 8.\ Ag\, e^{7.142857143\, x - 1.}, 0.1400000000 < x, -8.\ Rg\, e^{-25.\, x + 3.500000000} + 8.\ Ag\, e^{-7.142857143\, x + 1.}\right) \tag{10}$$

```
> eq1:=216=vg1(0);
```

$$eq1 := 216 = -8.\ Rg + 8.\ Ag \tag{11}$$

```
> eq2:=72=vg2(0);
```

$$eq2 := 72 = -0.2415790674\ Rg + 2.943035530\ Ag \tag{12}$$

```
> solve({eq1,eq2},{Rg,Ag});
```

$$\{Rg = -2.762198619, Ag = 24.23780138\} \tag{13}$$

```
>
```