In [9]:
```
using Gadfly
using Interact
```

In [5]:
```
set_default_plot_size(25cm, 25cm)
```

An Equilibrium Business-Cycle Model

Key Equations

Real Household Budget Constraint: $$C + (1/P) \cdot \Delta B + \Delta K = (w/P) \cdot L^s + i \cdot (B/P + K) \tag{1}$$

No-Arbitrage Condition: $$i = (r/P) \cdot \kappa + \delta(\kappa) \tag{2}$$

Marginal Product of Capital: $$MPK = A \cdot \alpha \cdot K^{(\alpha-1)} \cdot L^{(1-\alpha)} \tag{3}$$

Marginal Product of Labour: $$MPL = A \cdot (1-\alpha) \cdot K^{\alpha} \cdot L^{-\alpha} \tag{4}$$

In [2]:
```
MPK(A, K, L, α) = A*α*K.^(α-1)*L^(1-α)

MPL(A, K, L, α) = A*(1-α)*K^α*L.^(-α)

BC(w_P, r_P, L_S, K_S, δ, C) = w_P*L_S+(r_P-δ)*K_S - C
```

Out[2]:
```
BC (generic function with 1 method)
```

In [3]:
```
#Initial state
A0 = 5
L_S=50
K_S=50
α=0.5 # such that 1-α = 0.5, in this case
w_P0 = MPL(A0, K_S, L_S, α)
r_P0 = MPK(A0, K_S, L_S, α)
domain = linspace(0, 400, 200);
```

In [8]:
```
@manipulate for A in 1:10

    k_domain=linspace(0.1, 4, 20)
    w_P = MPL(A, K_S, L_S, α)
    r_P = MPK(A, K_S, L_S, α)
    k0 = log.(3*r_P0)
    k = log.(3*r_P)


    # Capital Market
    labor_market = plot(
        layer(x=[L_S], y=[w_P0], Geom.point, Theme(default_color=colorant"blue")),
        layer(x=[L_S], y=[w_P], Geom.point, Theme(default_color=colorant"red")),
        layer(xintercept=[L_S], Geom.vline(color=["black"])),
        layer(x=domain, y=MPL(5, K_S, domain, α), Geom.line, Theme(default_color=colorant"blue")),
        layer(x=domain, y=MPL(A, K_S, domain, α), Geom.line, Theme(default_color=colorant"red")),
        Coord.Cartesian(xmin=0,xmax=100,ymin=0,ymax=5),
        Guide.Title("Labor Market"),
        Guide.xlabel("Labor, L"),
        Guide.ylabel("Real Wage Price, (w/P), MPL")
        )


    # Capital Market
    capital_market = plot(
        layer(x=[K_S], y=[r_P0], Geom.point, Theme(default_color=colorant"blue")),
        layer(x=[K_S], y=[r_P], Geom.point, Theme(default_color=colorant"red")),
        layer(xintercept=[K_S], Geom.vline(color=["black"])),
        layer(x=domain, y=MPK(5, domain, L_S, α), Geom.line, Theme(default_color=colorant"blue")),
        layer(x=domain, y=MPK(A, domain, L_S, α), Geom.line, Theme(default_color=colorant"red")),
        Coord.Cartesian(xmin=0,xmax=100,ymin=0,ymax=5),
        Guide.Title("Capital Market"),
        Guide.xlabel("Capital, K"),
        Guide.ylabel("Real Rental Price, (R/P), MPK")
        )


    # k_rate
    k_rate = plot(
        layer(x=[k0 k0], y=[k0*r_P0 (1/3)*e.^k0], Geom.line, Geom.point, Theme(default_color=colorant"blue")),
        layer(x=[k k], y=[k*r_P (1/3)*e.^k], Geom.line, Geom.point, Theme(default_color=colorant"red")),
        layer(x=k_domain, y=(1/3)*e.^k_domain, Geom.line, Theme(default_color=colorant"black")),
        layer(x=k_domain, y=k_domain*r_P0, Geom.line, Theme(default_color=colorant"blue")),
        layer(x=k_domain, y=k_domain*r_P, Geom.line, Theme(default_color=colorant"red")),
        Coord.Cartesian(xmin=0,xmax=4,ymin=0,ymax=15),
        Guide.Title("Choosing the Capital Utilization Rate"),
        Guide.xlabel("Capital Utilization Rate, k"),
        Guide.ylabel("Rental Income, Depreciation")
        )


    # Budget
    budget = plot(
        layer(x=domain, y=BC(w_P0, r_P0, L_S, K_S*k0, (1/3)*e^k0, domain), Geom.line, Theme(default_color=colorant"blue")),
        layer(x=domain, y=BC(w_P, r_P, L_S, K_S*k, (1/3)*e^k, domain), Geom.line, Theme(default_color=colorant"red")),
        Coord.Cartesian(xmin=0,xmax=250,ymin=0,ymax=250, fixed=true),
        Guide.Title("Household Budget Constraint"),
        Guide.xlabel("Consumption, C"),
        Guide.ylabel("Real saving")
        )

    gridstack([labor_market capital_market; k_rate budget])

end
```

A 8

Out[8]: