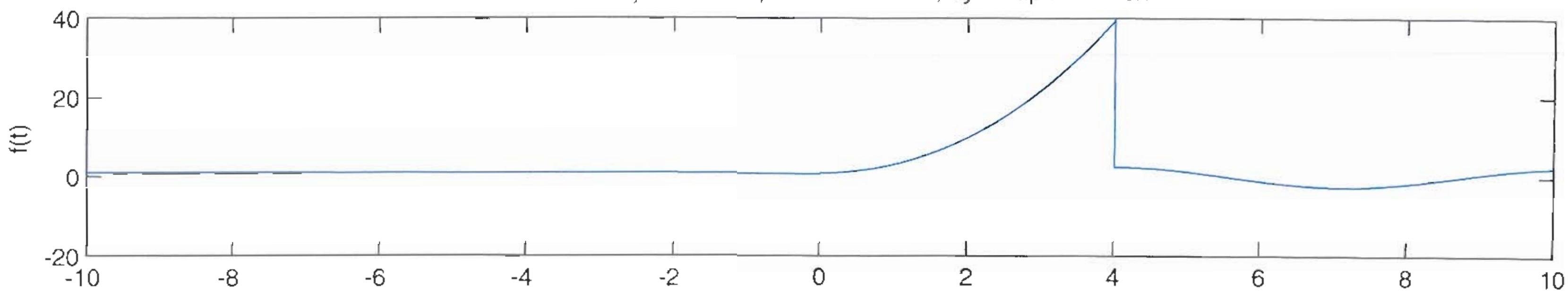
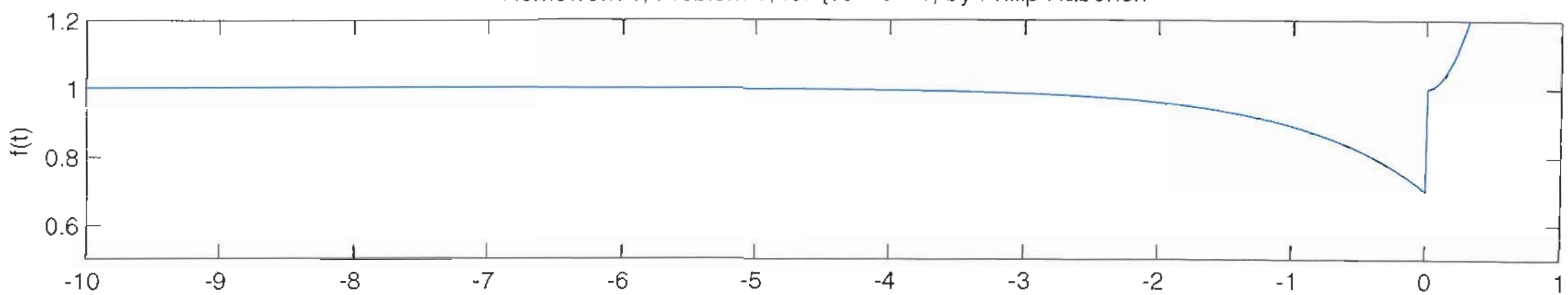
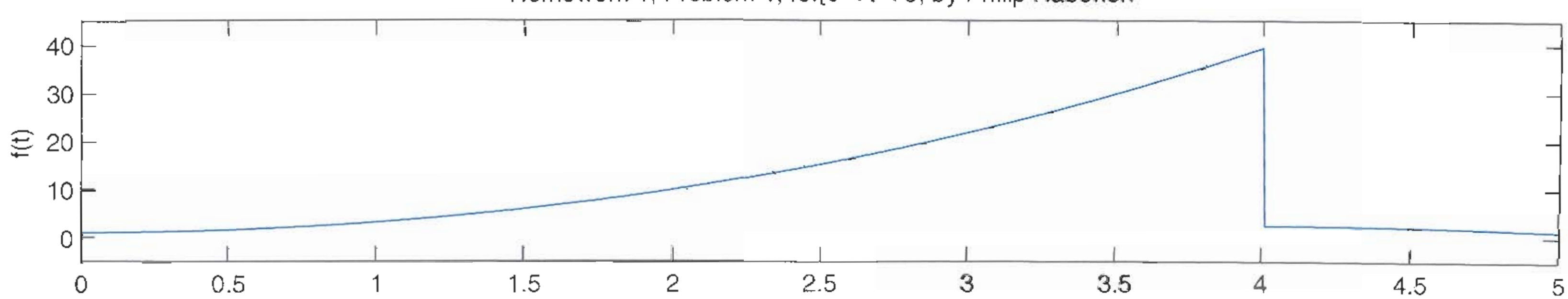
Homework 1, Problem 1, for -10 < t < 10, by Philip Haberlen



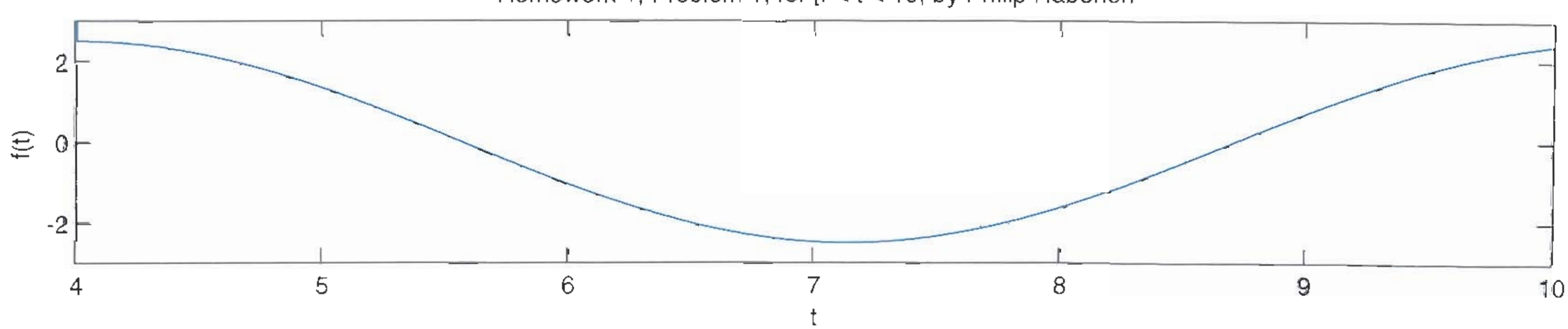
Homework 1, Problem 1, for -10 < t < 1, by Philip Haberlen

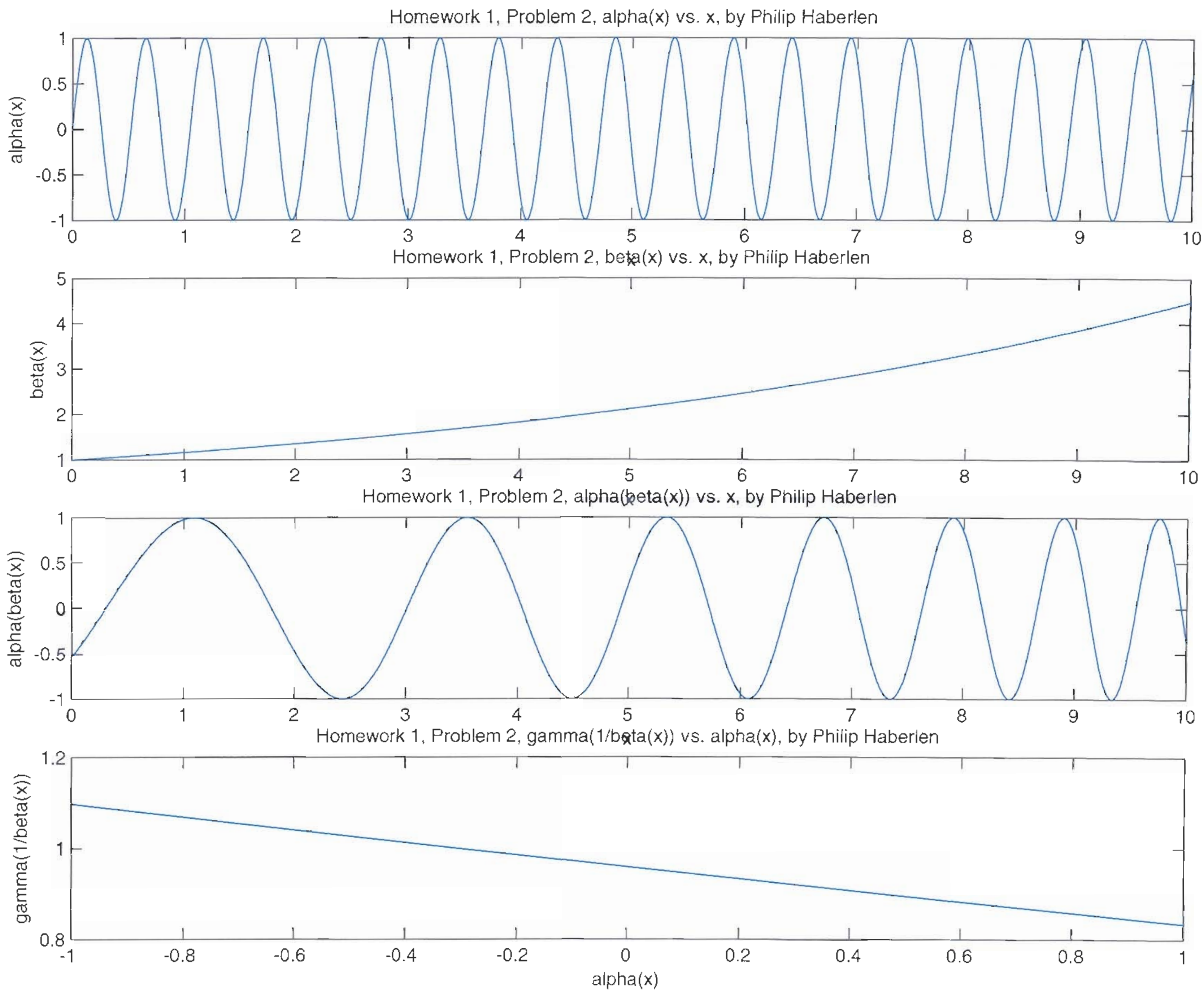


Homework 1, Problem 1, for 0 < t < 5, by Philip Haberlen



Homework 1, Problem 1, for 4 < t < 10, by Philip Haberlen




Homework 1, Problem 2, alpha(x) vs. x, by Philip Haberlen
alpha(x)
x
Homework 1, Problem 2, beta(x) vs. x, by Philip Haberlen
beta(x)
x
Homework 1, Problem 2, alpha(beta(x)) vs. x, by Philip Haberlen
alpha(beta(x))
x
Homework 1, Problem 2, gamma(1/beta(x)) vs. alpha(x), by Philip Haberlen
gamma(1/beta(x))
alpha(x)

Scripts for Homework #1, Problem #1, by Philip Haberlen

three_part_function.m which defines three_part_function(z):

```
function y = alpha(x)
y = sin(12.*x);
return
```

Script which generates the plots while calling "three_part_function":

```
step = .01;
t_values = -10:step:10;
number_t_value_elements = length(t_values);
a = 1;
for a = 1:number_t_value_elements,
        f_values(1, a) = three_part_function(t_values(1,a));
        a = a + 1;
end
subplot(4,1,1)
plot(t_values, f_values)
xlabel('t')
ylabel('f(t)')
title('Homework 1, Problem 1, for -10 < t < 10, by Philip Haberlen')
subplot(4,1,2)
plot(t_values, f_values)
axis ([-10, 1, .5, 1.2])
xlabel('t')
ylabel('f(t)')
title('Homework 1, Problem 1, for -10 < t < 1, by Philip Haberlen')
subplot(4,1,3)
plot(t_values, f_values)
axis ([0, 5, -5, 45])
xlabel('t')
ylabel('f(t)')
title('Homework 1, Problem 1, for 0 < t < 5, by Philip Haberlen')
subplot(4,1,4)
plot(t_values, f_values)
axis ([4, 10, -3, 3])
xlabel('t')
ylabel('f(t)')
title('Homework 1, Problem 1, for 4 < t < 10, by Philip Haberlen')
```

Scripts for Homework #1, Problem #2, by Philip Haberlen

alpha.m which defines alpha(x):

```
function y = alpha(x)
y = sin(12.*x);
return
```

beta.m which defines beta(x):

```
function y = beta(x)
y = exp(.15.*x);
return
```

gamma.m which defines gamma(x):

```
function y = gamma(x)
y = 2.*sin(x./2);
return
```

Script which generates the plots while calling the three functions above:

```
step = .01;
x = 0:step:10;
num_x_values = length(x);
a = 1;
b = 1;
c = 1;
d = 1;
for a = 1:num_x_values,
        y_1(1, a) = alpha(x(1, a));
        a = a + 1;
end
for b = 1:num_x_values,
y_2(1, b) = beta(x(1, b));
b = b + 1;
end
for c = 1:num_x_values,
y_3(1, c) = alpha(beta(x(1, c)));
c = c + 1;
end
for d = 1:num_x_values,
y_4(1, d) = gamma(1./(beta(alpha(x(1, d)))));
d = d + 1;
end
subplot(4,1,1)
plot(x, y_1)
title('Homework 1, Problem 2, alpha(x) vs. x, by Philip Haberlen')
xlabel('x')
ylabel('alpha(x)')
```

```
subplot(4,1,2)
plot(x, y_2)
title('Homework 1, Problem 2, beta(x) vs. x, by Philip Haberlen')
xlabel('x')
ylabel('beta(x)')
subplot(4,1,3)
plot(x, y_3)
title('Homework 1, Problem 2, alpha(beta(x)) vs. x, by Philip Haberlen')
xlabel('x')
ylabel('alpha(beta(x))')
subplot(4,1,4)
plot(y_1, y_4)
title('Homework 1, Problem 2, gamma(1/beta(x)) vs. alpha(x), by Philip
Haberlen')
xlabel('alpha(x)')
ylabel('gamma(1/beta(x))')
```

Philip Haberlen | Homework #1 Problem #3 | 8/30/04

Start with the first term in the numerator:

$$\underbrace{(17.15)}_{4\ SF}\underbrace{(295.1\ K)}_{4SF} = 5060.965\ K \longrightarrow \underbrace{5061\ K}_{4\ SF}$$

SF = "Significant Figures"

Now perform the subtraction in the numerator

$$\underset{\underbrace{(5061)}_{0\ DP}}{5060.965}\ K - \underbrace{4684\ K}_{0\ DP} = 376.965\ K \longrightarrow \underbrace{377\ K}_{0\ DP}$$

DP = "Decimal Places"

Note that extra significant digits are kept for intermediate calculations.

Now perform the subtraction in the denominator

$$\underbrace{295.1\ K}_{1\ DP} - \underbrace{38.25\ K}_{2\ DP} = 256.85\ K \longrightarrow \underbrace{256.8\ K}_{1\ DP}$$

Limiting factor is 295.1 K.

Now do the division inside the brackets

$$\frac{376.965\ K}{256.85\ K} = 1.467646\ldots \longrightarrow \underbrace{1.47}_{3\ SF}$$

Intermediate numbers used for calculation. Remember, the "rounded" numbers are 377 K and 256.8 K, which contain 3 and 4 SFs respectively. So, the answer should have 3 SFs.

Now raise "e" to the previously computed number

$$\underset{\underset{(1.47)\ 3\text{ SF}}{\uparrow}}{e^{1.4676416\ldots}} = 4.33901\ldots \longrightarrow \underbrace{4.34}_{3\text{ SF}}$$

Mathematical quantities such as e and π are known to many significant figures, so they are NOT the limiting factor for calculations.

And finally, the last calculation

$$\underbrace{(6.108)}_{4\text{ SF}}\underbrace{(0.85)}_{2\text{ SF}}\underset{\underset{\underbrace{(4.34)}_{3\text{ SF}}}{\uparrow}}{(4.33901\ldots)} = 22.5272\ldots \longrightarrow \underbrace{23}_{2\text{ SF}} = e_o$$

RH is the limiting factor in this case (only 2 SF), so the final answer, e_o, can have only 2 SF.

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In order to compute n, recognize that the two quantities in the parentheses must have the same dimensions since they are being added. So...

$$\frac{1}{\rho}\frac{d\rho}{dz} = \left(\frac{1}{M/L^3}\right)\left(\frac{M/L^3}{L}\right) = \frac{1}{L}$$

Therefore...

M = mass
L = length
T = time

$$\frac{g}{c^n} = \frac{L/T^2}{(L/T)^n} = \frac{1}{L} \quad \text{OR}$$

$$\left(\frac{L}{T^2}\right)\left(\frac{T}{L}\right)^n = \left(\frac{L}{T^2}\right)\left(\frac{T^n}{L^n}\right) = \frac{1}{L}$$

So by inspection, $n = 2.$

In order to find the units of N...

$$\sqrt{\ominus g\left(\frac{1}{L}\right)} = \sqrt{\frac{L}{T^2}\left(\frac{1}{L}\right)} = \sqrt{\frac{1}{T^2}} = \frac{1}{T}$$

The negative sign is irrelevant for dimensional analysis.

Thus, the units of N are $\frac{\text{radians}}{\text{second}}$. Note that a radian is dimensionless.