T2 TEST SOLUTIONS

FRI 1 FEB 2019

1) Vertex of: A) $f(x) = x^2 \rightarrow (0,0)$ B) $f(x) = (x-3)^2 \rightarrow (3,0)$

C) $f(x) = (x-3)^2 - 1 \rightarrow (3,-1)$ D) $f(x) = 2(x-11)^2 - 7 \rightarrow (11,-7)$

E) $f(x) = \frac{2}{5}(x+11)^2 + 35 \rightarrow (-11,35)$

2) A): $x=0$ B) $x=3$ C) $x=3$ D) $x=11$ E) $x=-11$

3) Given $f(x)=-\frac{1}{3}(x-2)^2-5$, find expressions of:

1) $g(t)=f(3t)=-\frac{1}{3}(3t-2)^2-5$ ← Not in vertex form. Hence, we can "simplify"

It must be

$=-\frac{1}{3}[3(t+a)]^2-5=-\frac{1}{3}\left[3\left(t-\frac{2}{3}\right)\right]^2-5=$

$3a=-2$

$\frac{3a}{3}=\frac{-2}{3}$

$a=-2/3$

$=-\frac{1}{3}3^2\left(t-\frac{2}{3}\right)^2-5=-3\left(t-\frac{2}{3}\right)^2-5$

3) 2) $h(t) = f(t+3) = -\frac{1}{3}(t+3-2)^2 - 5 = \boxed{-\frac{1}{3}(t+1)^2 - 5}$

[Reminder $f(x) = -\frac{1}{3}(x-2)^2 - 5$]

3.3) $r(t) = f(5t+5) = -\frac{1}{3}(5t+5-2)^2 - 5 = -\frac{1}{3}(5t+3)^2 - 5 =$

$= -\frac{1}{3}\left[5(t+q)\right]^2 - 5 = -\frac{1}{3}\left(5\left(t+\frac{3}{5}\right)\right)^2 - 5 =$

It must be $5q = 3$

$\frac{5q}{5} = \frac{3}{5} \rightarrow q = \frac{3}{5}$

$= -\frac{1}{3}5^2\left(t+\frac{3}{5}\right)^2 - 5 = \boxed{-\frac{25}{3}\left(t+\frac{3}{5}\right)^2 - 5}$

3.4) $s(t) = -5\,h(5t+5) - 25 = -5\left\{-\frac{1}{3}(5t+5+1)^2 - 5\right\} - 25 =$

[Reminder $h(t) = -\frac{1}{3}(t+1)^2 - 5$]

$= -5\left\{-\frac{1}{3}(5t+6)^2 - 5\right\} - 25 =$

$= +\frac{5}{3}(5t+6)^2 + 25 - 25 = \frac{5}{3}(5t+6)^2 = \frac{5}{3}\left[5(t+a)\right]^2$

It must be

$5a = 6$

$\frac{5a}{5} = \frac{6}{5} \to a = \frac{6}{5}$

$= \frac{5}{3}\left[5\left(t+\frac{6}{5}\right)\right]^2 = \frac{5}{3}\,5^2\left(t+\frac{6}{5}\right)^2 =$

$= \frac{5}{3}\cdot 25\left(t+\frac{6}{5}\right)^2 = \frac{125}{3}\left(t+\frac{6}{5}\right)^2$

4) $f(x) = x^2$. Describe transformations

4.1) $g(x) = (x-3)^2$

A) Horizontal translation of 3 unit right

B) Vertical translation of NONE

C) Compression NONE

4.2) $h(x) = 2(x-11)^2 - 7$

A) Horizontal translation of 11 units right

B) Vertical " " " 7 " down

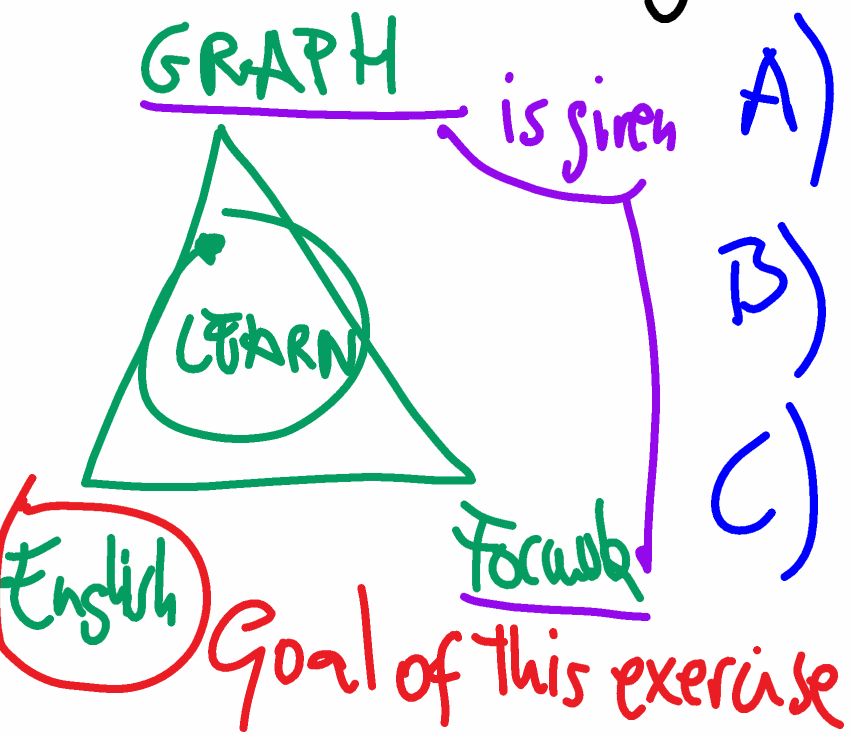
C) Compression along X-axis by factor 2

TJST solutions (cont.)

Tue 5 feb 2019

4.3) Given $f(x)=x^2$, describe transformations

$$r(x)=\frac{2}{5}(x+11)^2+35$$

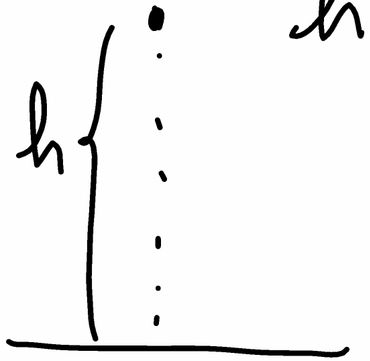


A) Horizontal translation of -11 units left

B) Vertical translation of 35 units up

C) Compression along y-axis

Problem

1) 

$h(t) = 100 - 4.9t^2$

1.1) Initial height: Ans: Initial means at $t=0$

$h(0) = 100 - 4.9 \cdot 0 = \underline{\underline{100}}$ m

1.2) At what time does ball reach floor?

Ans: Reach floor means $h(t) = 0$

$0 = 100 - 4.9 \cdot t^2$

Short way } $\frac{4.9 \cdot t^2}{4.9} = \frac{100}{4.9} \rightarrow \sqrt{t^2} = \sqrt{\frac{100}{4.9}} \rightarrow t = \pm\sqrt{\frac{100}{4.9}}$

Only one meaningful

Hence $t \approx 4.52$ sec

Long Way (using quadratic formula)

$0 = 100 - 4.9t^2$

$a = -4.9$
$b = 0$
$c = 100$

$t = \frac{0 \pm \sqrt{0 - 4(-4.9)100}}{-9.8} =$

$t = \frac{\pm\sqrt{4 \cdot 4.9 \cdot 100}}{-9.8} = \frac{\pm\sqrt{1960}}{-9.8}$

$t = \frac{\pm 44.2789}{-9.8} =$ $+ \frac{44.2789}{-9.8}$ Not meaningful

$- \frac{-44.2789}{-9.8} \simeq 4.52$ sec

$ax^2 + bx + c = 0$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

1.3) What is the height after 4 sec of throwing ball?

ANS: height means $h(t)$

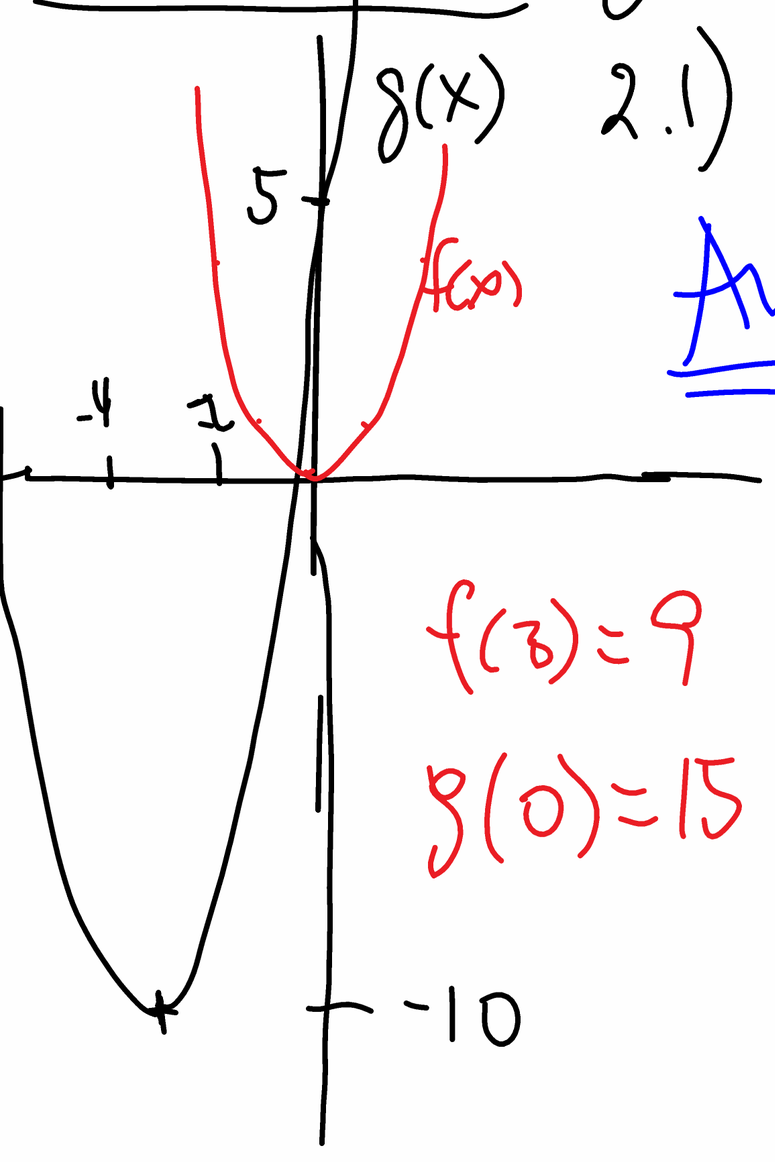
after 4s throwing means $t=4$

$$h(4) = 100 - 4.9 \cdot 4^2 = 100 - 4.9 \cdot 16 = 100 - 78.4$$

$$\boxed{h(4) = 21.6 \text{ m}}$$

Problem 2) Given figure 2.2) Sketch $h(x)=\frac{1}{2}g(x-6)+5$

2.1) Explain transformations of $g(x)$ wrt $f(x)=x^2$



$f(3)=9$

$g(0)=15$

Ans: translations only require looking at the vertex

1) Horizontal translation of 3 units left

2) Vertical translation of 10 units down

3) Vertical stretch by
Horizontal Compression by $\frac{15}{9}=\boxed{\frac{5}{3}}$

2.2) $h(x) = \frac{1}{2}\boxed{g(x-6)+5} = \frac{1}{2}\left[\frac{5}{3}(x-6+3)^2-10\right]+5 =$

$= \frac{1}{2}\cdot\frac{5}{3}(x-3)^2-5 = \boxed{\frac{5}{6}(x-3)^2-5}$

$g(x) = \frac{5}{3}(x+3)^2-10$

$h(0) = \frac{5}{6}\cdot 3^2-5 = \frac{5\cdot 3}{2}-5$

$= \frac{15}{2}-\frac{5\cdot 2}{2} = \frac{5}{2}$