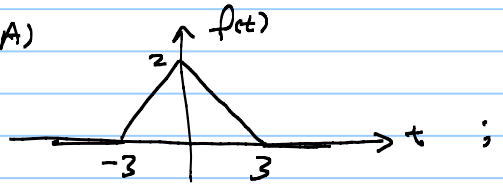
EE362_FS2018_Examples_Set_1

Note Title 8/30/2018

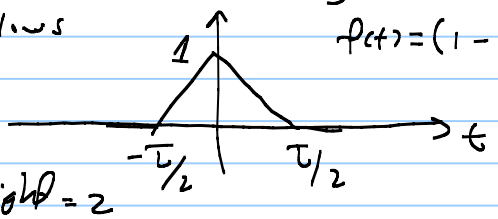
Express the following signals in terms of (1) rectangular and triangular functions; and (2) unit-step and unit-ramp functions.

(A)



;

The general form of a triangular function is as follows



$$f(t) = \left(1 - \frac{2|t|}{\tau}\right) P_\tau(t)$$

(1)

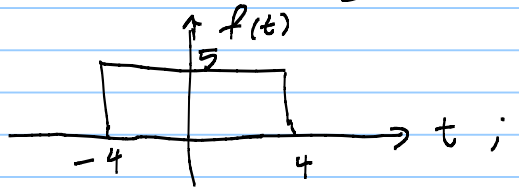
In our case $\tau = 6$ or $(\tau/2 = 3)$ & the height $= 2$

$$\therefore f(t) = 2\left(1 - \frac{2|t|}{6}\right) P_6(t) = 2\left(1 - \frac{|t|}{3}\right) P_6(t)$$

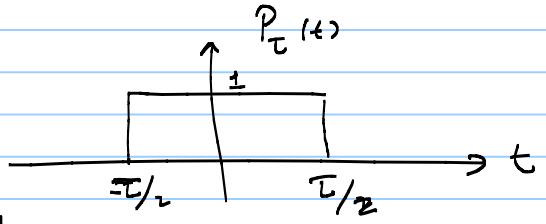
(2)

$$f(t) = \frac{2}{3} r(t+3) - \frac{4}{3} r(t) + \frac{2}{3} r(t-3)$$

(B)



;

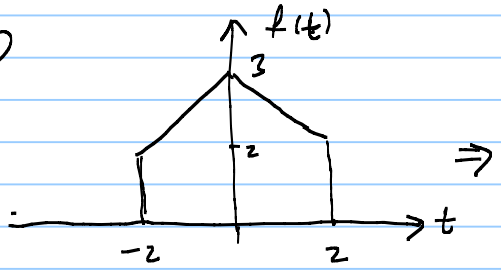


(1) In our case, $\tau = 8$ and the height $= 5$

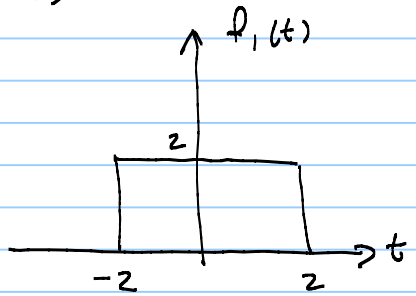
$$\therefore f(t) = 5 P_8(t)$$

(2) $f(t) = 5u(t+4) - 5u(t-4)$

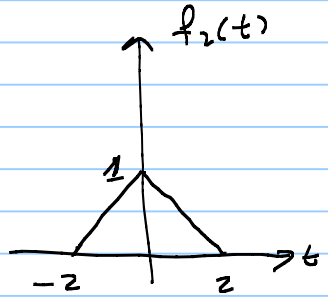
(C)



$\Rightarrow$



+



(1) $$f(t) = f_1(t) + f_2(t) = 2\underbrace{P_4(t)}_{f_1(t)} + \underbrace{\left(1 - \frac{2|t|}{4}\right) P_4(t)}_{f_2(t)}$$

(2) $$f(t) = 2u(t+2) + \frac{1}{2} r(t+2) - r(t) + \frac{1}{2} r(t-2) - 2u(t-2)$$

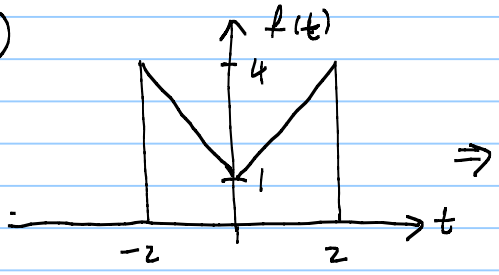
OR

$$f_1(t) = 2u(t+2) - 2u(t-2)$$

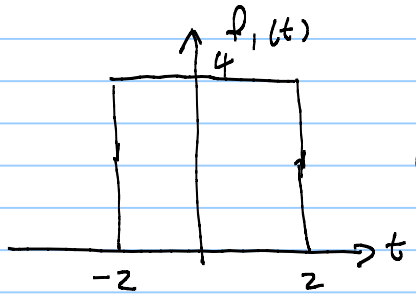
$$f_2(t) = \frac{1}{2} r(t+2) - r(t) + \frac{1}{2} r(t-2)$$

$$f(t) = f_1(t) + f_2(t)$$

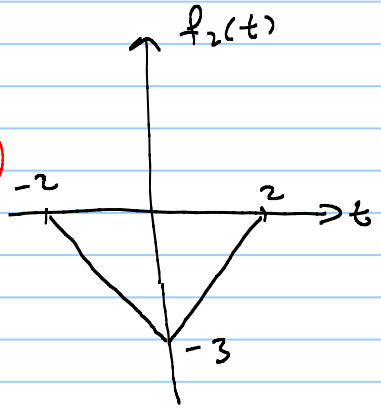
(D)



$\Rightarrow$



$+$



(1) $f(t) = f_1(t) + f_2(t) = \underbrace{4\,P_4(t)}_{f_1(t)} \underbrace{- 3\left(1 - \frac{2|t|}{4}\right) P_4(t)}_{f_2(t)}$

(2) $f(t) = 4u(t+2) - \frac{3}{2} r(t+2) + \frac{6}{2} r(t) - \frac{3}{2} r(t-2) - 4u(t-2)$

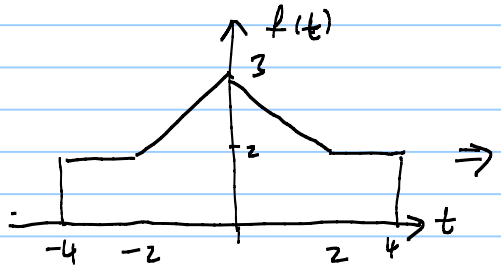
OR

$$f_1(t) = 4u(t+2) - 4u(t-2)$$

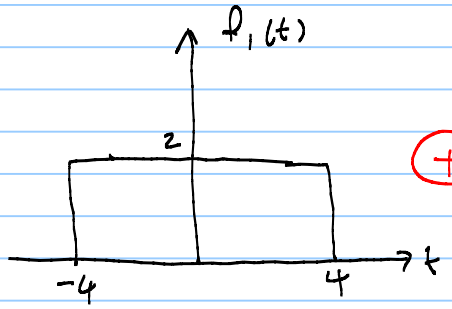
$$f_2(t) = -\frac{3}{2} r(t+2) + \frac{6}{2} r(t) - \frac{3}{2} r(t-2)$$

$$f(t) = f_1(t) + f_2(t)$$

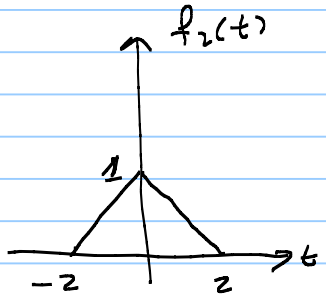
(E)



$\Rightarrow$



$+$



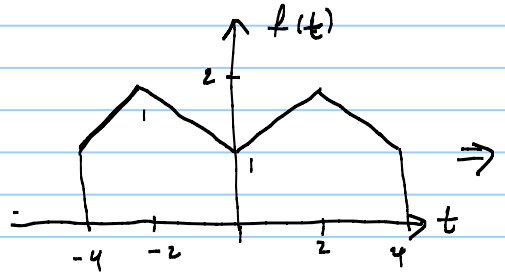
(1) $f(t) = f_1(t) + f_2(t) = \underbrace{2\,P_8(t)}_{f_1(t)} + \underbrace{\left(1 - \frac{2|t|}{4}\right) P_4(t)}_{f_2(t)}$

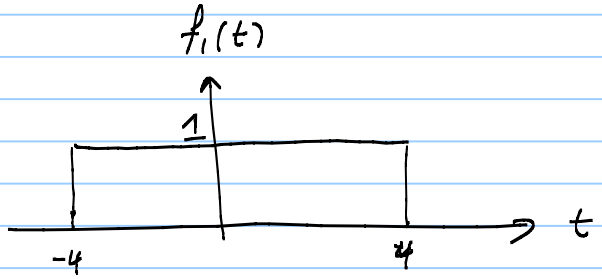
(2) $f(t) = 2u(t+4) + \frac{1}{2} r(t+2) - r(t) + \frac{1}{2} r(t-2) - 2u(t-4)$

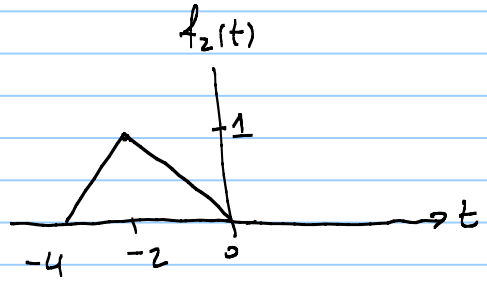
OR; $f_1(t) = 2u(t+4) - 2u(t-4)$

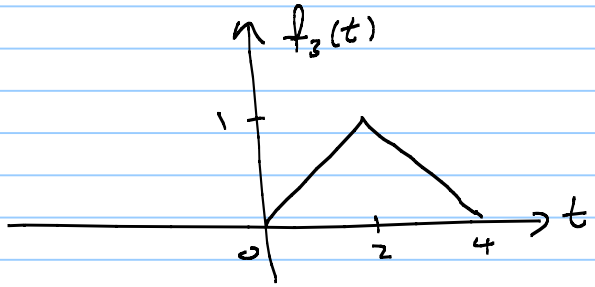
$f_2(t) = \frac{1}{2} r(t+2) - r(t) + \frac{1}{2} r(t-2)$ $\Big\}$ $f(t) = f_1(t) + f_2(t)$

(F)









(1)

$$f(t) = f_1(t) + f_2(t) + f_3(t)$$

$$f_1(t) = P_8(t)$$

$$f_2(t) = \left(1 - \frac{2|t+2|}{4}\right) P_4(t+2)$$

$$f_3(t) = \left(1 - \frac{2|t-2|}{4}\right) P_4(t-2)$$

(2) $r(t) = \frac{1}{2}r(t) + \frac{1}{2}r(t)$, right?

$$f(t) = u(t+4) + \frac{1}{2}r(t+4) - r(t+2) + r(t) - r(t-2) + \frac{1}{2}r(t-4) - u(t-4)$$

$$= u(t+4) + \frac{1}{2}r(t+4) - r(t+2) + \frac{1}{2}r(t) + \frac{1}{2}r(t) - r(t-2) + \frac{1}{2}r(t-4) - u(t-4)$$

$$= \underbrace{u(t+4) - u(t-4)}_{f_1(t)} + \underbrace{\frac{1}{2}r(t+4) - r(t+2) + \frac{1}{2}r(t)}_{f_2(t)} + \underbrace{\frac{1}{2}r(t) - r(t-2) + \frac{1}{2}r(t-4)}_{f_3(t)}$$

$$f(t) = f_1(t) + f_2(t) + f_3(t)$$

$$f_1(t) = P_8(t) = u(t+4) - u(t-4)$$

$$f_2(t) = \left(1 - \frac{2|t+2|}{4}\right) P_4(t+2) = \frac{1}{2}r(t+4) - r(t+2) + \frac{1}{2}r(t)$$

$$f_3(t) = \left(1 - \frac{2|t-2|}{4}\right) P_4(t-2) = \frac{1}{2}r(t) - r(t-2) + \frac{1}{2}r(t-4)$$