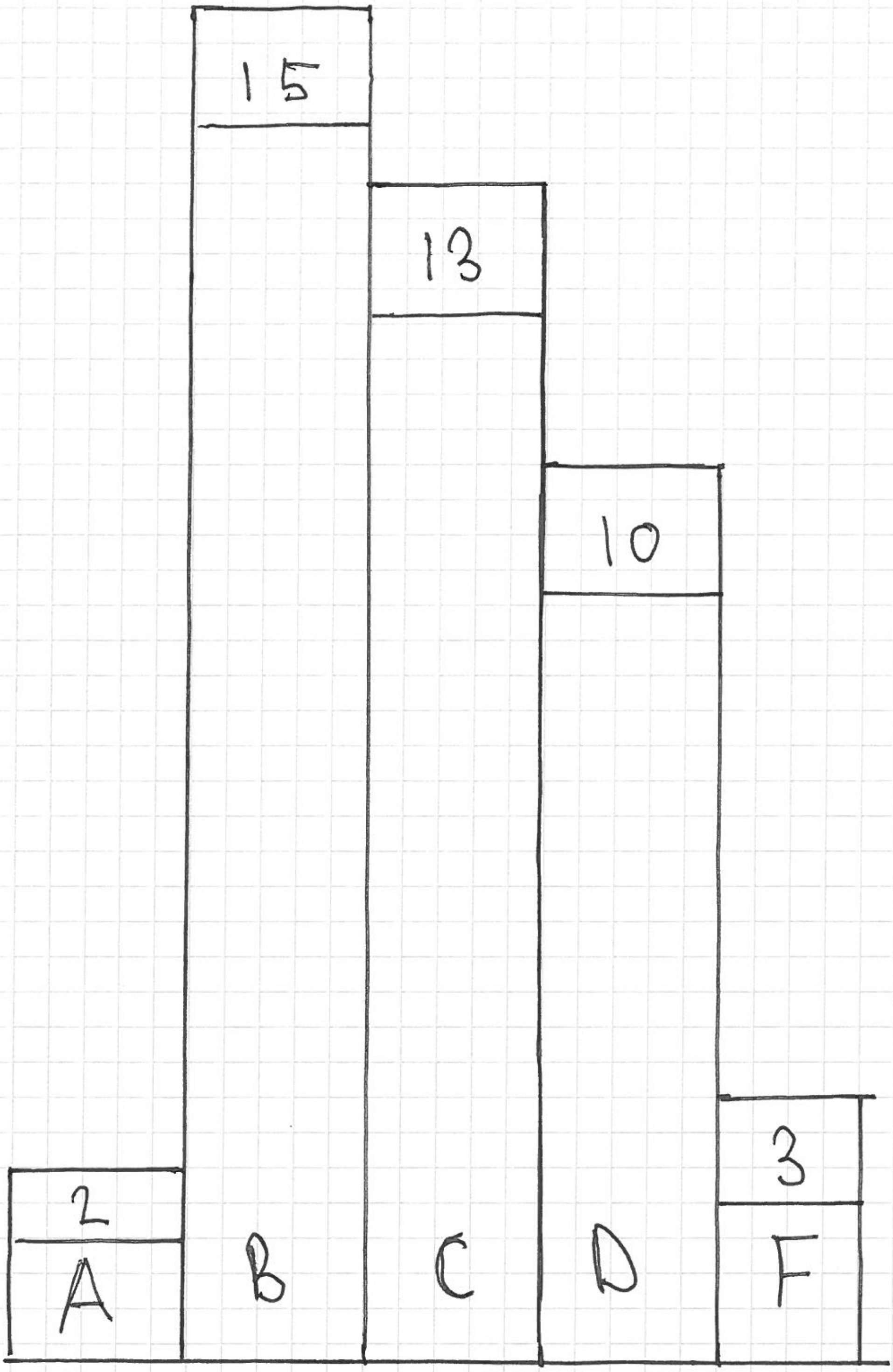
15
13
10
2
3
A
B
C
D
F

After Midterm 1

(1.) Second accepted solution: $\vec{\nabla} f(r) = \frac{df}{dr}\hat{r}$

$$f(r) = \frac{1}{2}r^2 \Rightarrow \nabla f(r) = r \cdot \hat{r} = \underline{\underline{\vec{r}}}$$

$$\vec{F} = -\nabla \phi(r) = -\vec{r}, \quad \phi(r) = \frac{1}{2}\vec{r}^{\,2}$$

3D Harmonic oscillator.

(2.) Product Rule for Differential Operators! Most frequent error: $\varepsilon_{ijk}\hat{x}_i x_k \partial_j r$ term forgotten.

Note, $\partial_j r = \frac{x_j}{r}$.

(3.) <u>Second correct way:</u>

$$\nabla \times \vec{F} = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ y & z & x \end{vmatrix} = \ldots = -\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

(and more ways)

(4) Vectors have <u>directions</u>!

$$\vec{F}_{\perp} = \vec{F} \cos\alpha$$
$$\vec{F}_{\parallel} = \vec{F} \sin\alpha$$

CANNOT be correct!

Point still in direction $\vec{F}$.

<u>Safest Solution:</u>

$$|\vec{F}_{\perp}| = |\vec{F}| \cos\alpha$$
$$|\vec{F}_{\parallel}| = |\vec{F}| \sin$$

<u>Reality Check</u>

$\alpha = 0$:

$|\vec{F}_{\perp}| = |\vec{F}|$

$|\vec{F}_{\parallel}| = 0$

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(5) <u>Limits:</u> $\alpha_1 = \alpha_2 = \frac{\pi}{2}$

$$T^1_x = T^2_x = 0$$

$$T^1_z = T^2_z = \frac{1}{2} F$$

$\alpha_1 = \alpha_2 \to 0$: $|T^1_x| = |-T^2_x| \to \infty$.

Some are weak in new part (1) - (3)
others in old (4) - (5).

After Midterm 1

$$\vec{T}^1 + \vec{T}^2 + \vec{F} = 0 \quad \text{Correct}$$

$$\vec{T}^1 \sin(\alpha_1) + \vec{T}^2 \sin(\alpha_2) + \vec{F} = 0 \quad \text{false!}$$

$$\Downarrow$$

$$T_z^1 \sin(\alpha_1) + T_z^2 \sin(\alpha_2) = F$$

$$= T^1 \sin^2(\alpha_1) + T^2 \sin^2(\alpha_1) = F$$

Correct is: $T^1 \sin(\alpha_1) + T^2 \sin(\alpha_2) = F$

Similarly follows: $T_x^1 \sin(\alpha_1) = T_x^2 \sin(\alpha_2)$

$$= T^1 \cos(\alpha_1) \sin(\alpha_1) + T^2 \cos(\alpha_2) \sin(\alpha_1)$$

Nonsense!

Correct is $T^1 \cos(\alpha_1) \quad T^2 \cos(\alpha_2)$.