

Problems for the LIFE review; Thurs, 12/8, 1-3 pm HELD 100

1. If P is the point (2,6) and Q is the point (-1,2), give a unit vector orthogonal to the vector from Q to P. Also, find a vector equation of the line passing through P and Q.
2. Let $\mathbf{a} = -2\mathbf{i} + 3\mathbf{j}$ and $\mathbf{b} = \mathbf{i} - 4\mathbf{j}$. What vector added to $2\mathbf{a}$ yields \mathbf{b} ?
3. A triangle has vertices $A(-3, -2)$, $B(1, 2)$, and $C(0, 4)$. Find the angle of the triangle at vertex A.
4. Given $\mathbf{a} = \langle 2, 7 \rangle$ and $\mathbf{b} = \langle -1, 2 \rangle$, find the scalar and vector projection of \mathbf{b} onto \mathbf{a}^\perp .
5. Find the work done by a force of 20 lbs acting in the direction $N50^\circ W$ in moving an object 4 feet due west.
6. Two forces, \vec{S} and \vec{T} , are acting on an object at a point P located at the origin. $|\vec{S}| = 20$ pounds and measures a reference angle of 45° . $|\vec{T}| = 16$ pounds and measures a reference angle of 30° . Find the resultant force as well as its magnitude and direction.
7. Find the linear approximation of $f(x) = \sqrt[3]{x}$ at $x = \frac{27}{8}$ and use it to approximate $\sqrt[3]{3}$.
8. The radius of a circular disk is given to be 24 cm with a maximum error in measurement of 0.2 cm. Use the differential, dA , to approximate the maximum error in the area of the disk.
9. Find the value(s) of c and d that makes $f(x)$ differentiable for all real x .

$$f(x) = \begin{cases} cx^2 - 1 & \text{for } x < 3 \\ 5d - cx & \text{for } x \geq 3 \end{cases}$$

10. $\lim_{x \rightarrow -\infty} (x + \sqrt{x^2 + 2x}) =$
11. For $f(x) = 5^{2x} + \log x - \arctan(x^2) + \sec(e^x)$, find $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$
12. Given $y = (\sin x)^{\frac{1}{x}}$, what is y' ?
13. $\tan(\sin^{-1} x) =$
14. A closed can is to be constructed in the shape of a cylinder. If the surface area of the can (including the top and bottom of the can) is fixed at 60 square feet, find the radius and height of the can with maximum volume.
15. Given $f'(x) = x - 3 \sin x$ and $f(0) = -2$, what is $f(\pi)$?
16. $d/dx \left(\int_{e^{2x}}^{\sin x} \sqrt{4 + 5t^4} dt \right) =$
17. Approximate $\int_{-2}^4 (16 - x^2) dx$ using a partition of $P = \{-2, 0, 4\}$ and taking $x_i^* =$ midpoint.
18. Find the equation of the line tangent to the curve $\mathbf{r}(t) = \left\langle te^{-t}, \frac{1}{\sqrt{t}} \right\rangle$ at the point $\left(\frac{1}{e}, 1 \right)$
19. If $f(x) = \sin(g(x))e^{h(x)}$, find an expression for $f'(x)$.

20. Find the limit or explain why it does not exist:

a) $\lim_{x \rightarrow 2} \frac{|x - 2|}{x^2 - 2x}$

b) $\lim_{x \rightarrow 0} \frac{\ln(1 + x) - x}{x^2}$

c) $\lim_{t \rightarrow 0} \frac{\sin^8(5t)}{t^8}$

21. Sand is being dumped at a rate of 100 cm^3 per second onto a pile in the shape of a cone whose diameter is one-half its height. How fast is the height of the pile increasing when the height is 75 cm?

22. Compute each of the following:

a) $\int \left(\frac{3}{\sqrt{1 - x^2}} + \frac{x}{3} + \frac{3}{x} \right) dx$

b) $\int_0^1 (x^2 - x)^2 dx$

c) $\int_1^4 \frac{3x - 1}{\sqrt{x}} dx$

23. Find $f'(x)$ for $f(x) = |9 - x^2|$.

24. Use area to evaluate $\int_{-3}^0 (1 + \sqrt{9 - x^2}) dx$ and $\int_0^3 |3x - 5| dx$.

25. Find the equation of the tangent line to the curve $4e^{xy} - e^x = y$ at the point $(0, 3)$.