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8 pt Find the derivative of $y = 4(5x^8 - 10x + 8)^{-2}$.

$$y' = 4(-2)(5x^8 - 10x + 8)^{-3}(40x^7 - 10)$$
$$= -\frac{8}{1} \cdot \frac{1}{(5x^8 - 10x + 8)^3} \cdot \frac{40x^7 - 10}{1}$$

1. **A** $\boxed{\dfrac{-320x^7 + 80}{(5x^8 - 10x + 8)^3}}$

B $\dfrac{-320x^7 + 80}{5x^8 - 10x + 8}$

C $\dfrac{2}{(40x^7 - 10)^3}$

D $\dfrac{-8}{(40x^7 - 10)^3}$

E $\dfrac{-8}{(5x^8 - 10x + 8)^3}$

F $\dfrac{2}{5x^8 - 10x + 8}$

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8 pt Find $f'(x)$ given $f(x) = \ln(x^2 + 5)$.

$$f'(x) = \frac{1}{x^2 + 5} \cdot 2x$$

2. **A** $\dfrac{2}{x + 5}$

B $\boxed{\dfrac{2x}{x^2 + 5}}$

C $\dfrac{1}{2x}$

D $\dfrac{2x + 5}{x^2 + 5}$

E $\dfrac{x^2 + 5}{x}$

F $\dfrac{2}{x}$

8 pt A particle moves along a straight line with the position function of

$$s(t) = t^3 - \frac{9}{2}t^2 - 6t,$$

where t is in seconds and $s(t)$ is in meters. Find the acceleration of the particle at $t = 2$ seconds. i.e. $a(2) = s''(2)$

$s'(t) = 3t^2 - \frac{9}{2} \cdot 2t - 6$

$= 3t^2 - 9t - 6$

$s''(t) = 6t - 9$

$s''(2) = 6(2) - 9 = 3$

3. A 17 m/sec^2

B 23 m/sec^2

C -10 m/sec^2

$\boxed{\textbf{D} \quad 3 \text{ m/sec}^2}$

E -20 m/sec^2

F 8 m/sec^2

---

8 pt Given that x and y are both differentiable functions of t and

$$xy = 6,$$

find $\frac{dx}{dt}$ when $x = \frac{1}{2}$ and $\frac{dy}{dt} = 72$.

$\frac{d}{dt}(xy) = \frac{d}{dt}(6)$

$\frac{d}{dt}(x) \cdot y + x \frac{d}{dt}(y) = 0$

$\frac{dx}{dt} \cdot y + x \frac{dy}{dt} = 0$

$\frac{dx}{dt} \cdot y + \frac{1}{2} \cdot 72 = 0$

$\frac{dx}{dt} \cdot y + 36 = 0$

$xy = 6$

$\frac{1}{2}y = 6$

$y = 12$

4. A -72

B 6

$\boxed{\textbf{C} \quad -3}$

D 0

E $\frac{1}{18}$

F $\frac{1}{12}$

$\frac{dx}{dt} = -\frac{36}{y} = -\frac{36}{12} = -3$

---

8 pt Find the derivative of $f(x) = \sin^3(4x)$. $= (\sin(4x))^3$

$f'(x) = 3(\sin(4x))^2 \cos(4x) \cdot 4$

5. $\boxed{\textbf{A} \quad 12\sin^2(4x)\cos(4x)}$

B $12\sin^2(4x)$

C $3\sin^2(4x)$

D $3\sin^2(4x)\cos(4x)$

E $4\sin^3(4x)$

F $4\cos^3(4x)$

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8 pt Find the x value at which the function $g(x) = \frac{7}{3}x^3 - 7x^2$ has a relative minimum.

$g'(x) = \frac{7}{3} \cdot 3x^2 - 7 \cdot 2x$

$= 7x^2 - 14x = 0$

$7x(x-2) = 0$

$x = 0, 2$

$+ \quad - \quad +$

$-1 \quad 1 \quad 3$

$0 \quad 2 \quad f'$

max min

6. **A** $x = \frac{7}{3}$

B $x = 0$

C $x = -2$

D $x = 7$

E $x = 3$

$\boxed{\textbf{F} \quad x = 2}$

---

8 pt All sides of a square are shrinking at a rate of 3 ft/min. How fast is the area of the square decreasing when each side is 4 ft?

$x \quad x$

$\frac{dx}{dt} = 3$

$x = 4$

$A = x^2$

$\frac{dA}{dt} = 2x\frac{dx}{dt}$

7. **A** 9 ft^2/min

B 12 ft^2/min

C 6 ft^2/min

D 8 ft^2/min

$\boxed{\textbf{E} \quad 24\ ft^2/min}$

F 16 ft^2/min

$= 2(3)(4) = 24$

8 pt Given $y = e^{3x} - \cos(5x)$, find y'.

$$y' = 3e^{3x} - (-\sin(5x)) \cdot 5$$
$$= 3e^{3x} + 5\sin(5x)$$

8. $\boxed{\textbf{A} \quad 3e^{3x} + 5\cos(5x)}$

B $9e^{3x} + 25\cos(5x)$

C $9e^{3x} - 5\cos(5x)$

D $3e^{3x} - 5\sin(5x)$

E $3e^{3x} - 25\sin(5x)$

F $9e^{3x} + 25\sin(5x)$

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8 pt Use implicit differentiation to find $\frac{\mathrm{d}y}{\mathrm{d}x}$ given

$$6y^2 = xy + 4$$

at the point of $(2, 1)$.

$$\frac{d}{dx}(6y^2) = \frac{d}{dx}(xy+4)$$
$$12y\frac{dy}{dx} = \frac{d}{dx}(xy) + \frac{d}{dx}(4)$$
$$12y\frac{dy}{dx} = \frac{d}{dx}(x)\cdot y + x\frac{d}{dx}(y) + 0$$
$$12y\frac{dy}{dx} = y + x\frac{dy}{dx}$$
$$12y\frac{dy}{dx} - x\frac{dy}{dx} = y$$

9. **A** $\frac{1}{11}$

B 11

$\boxed{\textbf{C} \quad \frac{1}{10}}$

D $\frac{11}{10}$

E $\frac{10}{11}$

F 10

$$(12y - x)\frac{dy}{dx} = y$$
$$\frac{dy}{dx} = \frac{y}{12y - x}$$
$$\left.\frac{dy}{dx}\right|_{(2,1)} = \frac{1}{12-2} = \frac{1}{10}$$

8 pt Find the critical number(s) of $y = 10x^3 e^x$.

10. **A** $\boxed{0 \text{ and } -3}$

B 0 only

C -3 and 3

D 3 only

E 0 and 3

F -3 only

$u(x)=10x^3 \quad v(x)=e^x$

$u'(x)=30x^2 \quad v'(x)=e^x$

$y'=u'v+v'u$

$=30x^2e^x+10x^3e^x=0$

$10x^2e^x[3+x]=0$

$10x^2=0$ | $e^x=0$ | $3+x=0$

$x=0$ | Never | $x=-3$

---

8 pt Given the **derivative**, $f'(x) = (x+8)^2(x-4)$, choose the correct statement regarding $f(x)$.

11. **A** $\boxed{f(x) \text{ is increasing on } (4, \infty).}$

B $f(x)$ is increasing on $(-8, 4)$.

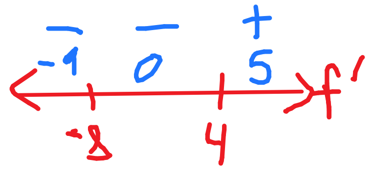
C $f(x)$ is increasing on $(-\infty, 4)$.

D $f(x)$ is increasing on $(-8, \infty)$.

E $f(x)$ is increasing on $(-\infty, -8)$ and $(4, \infty)$.

F $f(x)$ is increasing on $(-\infty, -8)$.

$f'(x)=0 \Rightarrow x=-8, 4$



Dec: $(-\infty, 4)$

Inc: $(4, \infty)$

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8 pt A car drives towards a 15 ft tall post. A sensor sits at the top of the post. If the distance between the car and the sensor is decreasing at a rate of 48 ft/s when the car is 36 ft away from the base of the post, how fast is the car driving?

12. **A** $\frac{576}{13}$ ft/s

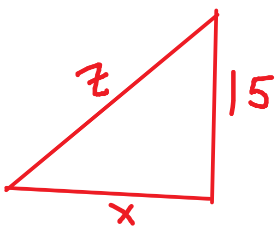
B $\boxed{52 \text{ ft/s}}$

C $4\sqrt{119}$ ft/s

D $3\sqrt{281}$ ft/s

E 39 ft/s

F $3\sqrt{231}$ ft/s



$\left.\frac{dz}{dt}\right|_{x=36} = -48$

$x^2+15^2=z^2$

$2x\frac{dx}{dt} = 2z\frac{dz}{dt}$

$2(36)\frac{dx}{dt} = 2z(-48)$

$\frac{dx}{dt} = \frac{-2 \cdot 48 z}{2 \cdot 36}$

$\frac{dx}{dt} = -\frac{4}{3}z$

$36^2+15^2=z^2$

$1296+225=z^2$

$1521=z^2$

$z=39$

$\frac{dx}{dt} = -\frac{4}{3}(39) = -4(13) = -52$