1 Given

$$y = \sqrt{3x^2 + 4},$$

find the derivative of y with respect to x.

a $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\sqrt{3x^2+4}}{2} = \dfrac{1}{2}(3x^2+4)^{1/2}$

b $\dfrac{\mathrm{d}y}{\mathrm{d}x} = 3x\sqrt{3x^2+4} = 3x(3x^2+4)^{1/2}$

c $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{3x\sqrt{3x^2+4}}{3x^2+4} = 3x(3x^2+4)^{-1/2}$

d $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{\sqrt{3x^2+4}}{2(3x^2+4)} = \dfrac{1}{2}(3x^2+4)^{-1/2}$

2 Given

$$3x + 4y = x^2 + y^3,$$

find the derivative of y with respect to x.

a $\dfrac{\mathrm{d}y}{\mathrm{d}x} = -\dfrac{2x-3}{3y^2-4}$

b $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{3y^2+2x}{7}$

c $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{3y^2+2x-3}{4}$

d $\dfrac{\mathrm{d}y}{\mathrm{d}x} = -\dfrac{2x-3}{3y-4}$

3 Given

$$x = t\mathrm{e}^{2t},$$

find the derivative of x with respect to t.

a $2\mathrm{e}^{2t}$

b $\mathrm{e}^{2t} + t\mathrm{e}^{2t} = (t+1)\mathrm{e}^{2t}$

c $2t\mathrm{e}^{2t}$

d $\mathrm{e}^{2t} + 2t\mathrm{e}^{2t} = (2t+1)\mathrm{e}^{2t}$

4 Given

$$f(x) = \frac{x+1}{x-4},$$

find f'.

a $f'(x) = -\dfrac{5}{(x+1)^2}$

b $f'(x) = \dfrac{5}{(x-4)^2}$

c $f'(x) = -\dfrac{5}{(x-4)^2}$

d $f'(x) = \dfrac{5}{(x+1)^2}$

5 Given

$$g(x) = 4x^3 + 2x^2,$$

find g''.

a $g''(x) = 12x^2 + 4x$

b $g''(x) = 24x + 4$

c $g''(x) = 24x^2 + 4x$

d $g''(x) = 12x + 4$

6 Evaluate

$$\lim_{x\to 6} \left(\frac{x^2 - 36}{x - 6} \right).$$

a 12

b ∞

c $-\infty$

d undefined

7 Evaluate

$$\lim_{x\to -\infty} (x^4 + 5x^2).$$

a 24

b ∞

c $-\infty$

d undefined

8 Evaluate

$$\lim_{x\to -3^-} \left(\frac{x^2 + 3}{x + 3} \right).$$

a 6

b ∞

c $-\infty$

d undefined

9 Given

$$f(x) = \sqrt{100 - x^3},$$

find the maximum and minimum value of f, if they exist.

a maximum is 10, minimum is 0

b maximum is 10, no minimum

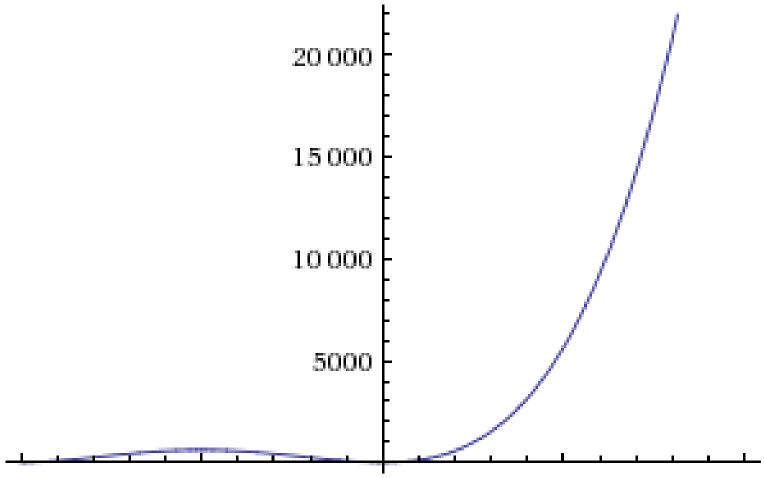
c no maximum, minimum is 0

d no maximum, no minimum

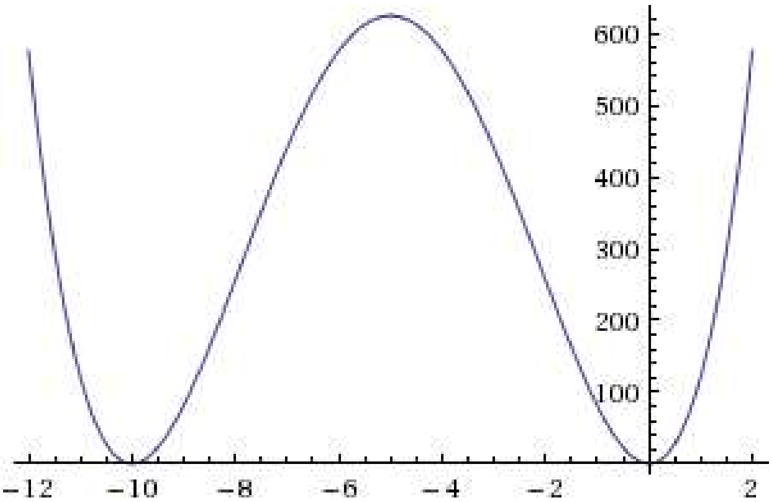
10 Given

$$f(x) = x^4 + 20x^3 + 100x^2,$$

sketch a graph of f that shows all intercepts (if any), all local extrema (if any), and both infinite limits (if applicable).



a



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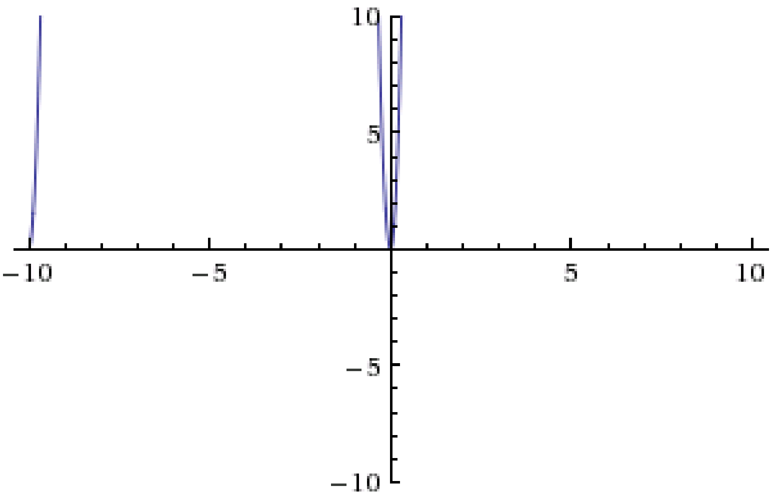
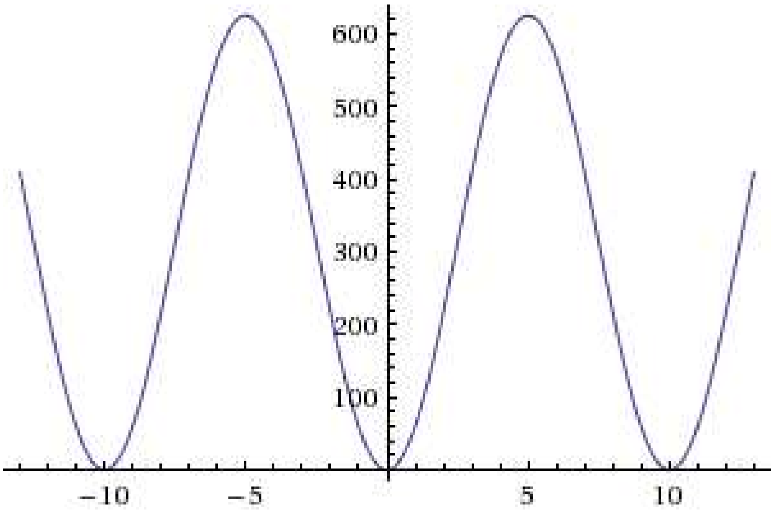


c

d 

11 Find the value of

$$\int_0^1 (4x^3 - 3x^2 + 4x - 2)\,\mathrm{d}x.$$

a 4

b 2

c 0

d 3

12 Given

$$f(x) = \frac{1}{x+2} + \mathrm{e}^{3x},$$

find the antiderivatives (indefinite integrals) of f.

a $\int f(x)\,\mathrm{d}x = \frac{1}{2}\ln(x+2) + \frac{1}{3}\mathrm{e}^{3x} + C$

b $\int f(x)\,\mathrm{d}x = \ln(x+2) + \mathrm{e}^{3x} + C$

c $\int f(x)\,\mathrm{d}x = \frac{1}{2}\ln(x+2) + \mathrm{e}^{3x} + C$

d $\int f(x)\,\mathrm{d}x = \ln(x+2) + \frac{1}{3}\mathrm{e}^{3x} + C$

13 Suppose that a leaking oil platform is forming a circular oil slick. At the moment, the radius of this slick is 100 metres, and it's increasing at a rate of 3 metre per hour. How fast is the area of the oil slick increasing?

a $900\pi\,\mathrm{m}^2/\mathrm{h}$

b $30{,}000\pi\,\mathrm{m}^2/\mathrm{h}$

c $300\pi\,\mathrm{m}^2/\mathrm{h}$

d $600\pi\,\mathrm{m}^2/\mathrm{h}$

14 Suppose that the revenue from selling x thousand items in a year is

$$R = 10x - x^2,$$

while the cost to make them is

$$C = 2x + 10,$$

both measured in millions of dollars. How much should be made and sold in a year to maximise profit?

a 2000 per year

b 3000 per year

c 4000 per year

d 5000 per year

15 The annual relative growth rate of the world population of humans is estimated to be about 1.1 % now, and the population was exactly 7 billion right about the beginning of last year (2012). If the same relative growth rate is maintained, what will the population be at the beginning of 2050?

a $7\mathrm{e}^{209/500} \approx 10.6$ billion

b $7 \cdot 10^{209/500} \approx 18.3$ billion

c $7 \cdot 2^{209/500} \approx 9.3$ billion

d $7 \cdot 7^{209/500} = 7^{709/500} \approx 15.8$ billion

Answers

1 C, 2 A, 3 D, 4 C, 5 B, 6 A, 7 B, 8 C, 9 A, 10 B, 11 C, 12 D, 13 D, 14 C, 15 A.