1. An ice hockey puck is sliding along a straight line so that its position is $s(t) = \frac{t^3}{3} + t^2 + t - \frac{7}{3}$. At which times t is the velocity of the puck increasing?

   A. $t < -1$

   B. $t < 1$

   C. $t > -1$

   D. $t > 1$

   E. All t except $t = -1$

2. The power P (in watts) generated by a windmill is given by $P(V) = 1.302V^{3/2}$, where V is the wind velocity in feet per second. Use increments to estimate the change in power produced when the wind speed changes from 16 feet per second to 21 feet per second. Round your answer to two decimal places.

   A. 38.15 watts

   B. 39.06 watts

   C. 40.28 watts

   D. 41.05 watts

   E. 41.97 watts

3. Find an equation of the tangent line to the graph of $f(x) = (x^3 - 3x^2 + 1)(2x^4 - 1)$ at $x = -1$.

   A. $y = 33x + 30.$

   B. $y = -72x - 75.$

   C. $y = x.$

   D. $y = 23x + 20.$

   E. $y = x + 2.$

4. Given $h(x) = (f(x) - 2x)(g(x) + 2)$, where $f(1) = 3, g(1) = -5, f'(1) = 1$, and $g'(1) = 2$, find $h'(1)$.

   A. -2

   B. -1

   C. 1

   D. 0

   E. 5

5. When the price of a certain commodity is p dollars per unit consumers demand x units per month where $2p^2 + 3px - x^2 = 1$. At what rate is demand changing with respect to time when the price is \$2.00 and is decreasing at a rate of \$0.10 per month. Round your answer to two decimal places.

   A. -0.35

   B. 0.28

   C. -0.06

   D. -0.36

   E. 0.06

6. Differentiate $h(x) = \left(\dfrac{x^2+1}{1-x^2}\right)^4$ and simplify.

A. $\dfrac{16x(x^2+1)^3}{(1-x^2)^5}$.

B. $\dfrac{4(x^2+1)^3}{(1-x^2)^3}$.

C. $\dfrac{(x^2+1)^3}{(1-x^2)^3}$.

D. $\dfrac{-16x^3(x^2+1)^3}{(1-x^2)^5}$.

E. $\dfrac{-4x(x^2+1)^3}{(1-x^2)^3}$.

7. On January 1, 2013, at a price of x dollars, the demand for a certain product was $D(x) = \dfrac{300}{x^2} + 10\sqrt{x}$ thousand units per month. t months after January 1, 2013, it is estimated that the price of the product will be $x(t) = 3t^{4/3} + 16$ dollars. At what rate is the demand changing on September 1, 2013? Round your answer to two decimal places.

A. 4.98 thousand units per month

B. 4.88 thousand units per month

C. 4.79 thousand units per month

D. 5.08 thousand units per month

E. 5.17 thousand units per month

8. The output Q at a factory is related to inputs x and y by the equation

$$Q = x^3 + x^2 y + 2y^3.$$

Currently, the input levels are $x = 5$ and $y = 10$. Estimate the change in input x to offset a decrease of 0.2 in input y so that the output will be maintained at the current level.

A. 1/9

B. 3/7

C. 4/9

D. 7/5

E. 5/7

9. A cone's volume is decreasing at a rate of 30π cm^3 per minute while its height is increasing at a rate of 5 cm per minute. Find the rate at which the cone's radius is changing with respect to time when its height is 18 cm and its volume is 216π cm^3. (Hint: $V = \frac{1}{3}\pi r^2 h$)

A. $\frac{3}{2}$ cm per minute

B. $-\frac{5}{4}$ cm per minute

C. $-\frac{1}{12}$ cm per minute

D. $-\frac{3}{2}$ cm per minute

E. $-\frac{5}{12}$ cm per minute

10. The cost of producing d hundred plastic toy dinosaurs per day in a small company is $C(d) = 120 + 30d + \frac{1}{8}d^4$ dollars. This company is currently producing 500 dinosaurs each day. Using calculus, estimate how much the company should change the production to make their daily cost approximately 250 dollars.

    A. Increase by 106 dinosaurs per day

    B. Increase by 270 dinosaurs per day

    C. Decrease by 106 dinosaurs per day

    D. Decrease by 138 dinosaurs per day

    E. Decrease by 270 dinosaurs per day

11. Find $\dfrac{dy}{dx}$ if $2y^3 - xy + 7x^2 = 10x$.

    A. $\dfrac{dy}{dx} = -\dfrac{10 - 6y^2 + y - 14x}{x}$

    B. $\dfrac{dy}{dx} = \dfrac{10 - 14x}{6y^2 - 1}$

    C. $\dfrac{dy}{dx} = \dfrac{10 + y - 14x}{6y^2 + x}$

    D. $\dfrac{dy}{dx} = 6y^2 + 14x - 10$

    E. $\dfrac{dy}{dx} = \dfrac{10 + y - 14x}{6y^2 - x}$

12. On which intervals is $f(x) = 40x^3 - 6x^5$ increasing?

   A. When $x < -2$ and $x > 2$

   B. When $x < -2$ and $0 < x < 2$

   C. When $-2 < x < 0$ and $x > 2$

   D. When $-2 < x < 0$ and $0 < x < 2$

   E. When $x < 0$ and $x > 2$

13. Find the interval(s) where the function is increasing for

$$f(x) = \sqrt{2x^2 - 5x - 3}$$

   A. $x > 3$

   B. $x > -1/2$

   C. $x > 3$ and $x < -1/2$

   D. $x < -1/2$

   E. $x < -5/4$

14. Determine the critical numbers of the function and classify each critical point as a relative maximum, a relative minimum, or neither.

$$f(x) = \frac{x^3}{x+1}$$

A. Relative Minimum when $x = -3/2$ and $x = -1$, neither when $x = 0$

B. Relative Maximum when $x = -3/2$, Relative Minimum when $x = 0$

C. Relative Minimum when $x = -3/2$, neither when $x = 0$

D. Relative Minimum when $x = -3/2$ and $x = 0$

E. Relative Maximum when $x = 0$, Relative Minimum when $x = -1$ and $x = -3/2$

15. The concentration of aspirin in a patient's bloodstream x minutes after taking the the aspirin is given by $C(x) = \dfrac{0.62x}{x^2 + 1.60}$ mg/L. What is the maximum concentration reached?

A. 0.238 mg/L

B. 0.245 mg/L

C. 0.388 mg/L

D. 1.265 mg/L

E. 1.600 mg/L