1. Let $f(x) = \sqrt{x}$. What is the equation of the tangent line to f at the point $(4, 2)$?

   (a) $y = -\frac{1}{2}x + 3$

   (b) $y = \frac{1}{2}x$

   (c) $y = 2x - 6$

   (d) $y = \frac{1}{4}x + 1$

2. What is the derivative of $s(t) = \sec\sqrt{t}$?

   (a) $\sec\frac{1}{2\sqrt{t}}\tan\frac{1}{2\sqrt{t}}$

   (b) $\frac{\sec\sqrt{t}\tan\sqrt{t}}{2\sqrt{t}}$

   (c) $\sec\sqrt{t}\tan\sqrt{t}$

   (d) $\tan^2\sqrt{t}$

3. If f, g, and h are nonzero differentiable functions, then the derivative of $\frac{fg}{h}$ is

   (a) $\frac{fg'h' - fgh'}{h^2}$

   (b) $\frac{fgh' - fg'h - f'gh}{h^2}$

   (c) $\frac{f'gh + fg'h + fgh'}{h^2}$

   (d) $\frac{fg'h + f'gh - fgh'}{h^2}$

   (e) $\frac{fg' + f'g}{h'}$

4. The line tangent to the curve $y = \sqrt{16 - x}$ at the point $(0, 4)$ has slope

   (a) 4

   (b) 1/8

   (c) $-1/8$

   (d) -8

   (e) 8

5. At what point(s) on the curve $x^2 - y^2 + x = 2$ is the tangent line vertical?

   (a) $(-2, 0)$ only

   (b) $(1, \sqrt{2})$ only

   (c) $(1, 0)$ and $(-2, 0)$

   (d) The tangent line is never vertical

   (e) $(1, 0)$ only

6. If $y = 6\cos(3x)$ then what is y' ?

   (a) $18\sin(x)$

   (b) $18\sin(3x)$

   (c) $-18\sin(3x)$

   (d) $-6\sin(3x)$

7. What is the value of

$$\lim_{\Delta x \to 0} \frac{2(x+\Delta x)^2 - 2x^2}{\Delta x}$$

(a) $4x$

(b) 4

(c) 2

(d) Does not exist

(e) $2x$

8. If $w(t) = \sqrt{t^2 - 1}$ what is the value of $w'(4)$?

(a) $\frac{2}{\sqrt{15}}$

(b) $\frac{1}{\sqrt{15}}$

(c) $\frac{1}{2\sqrt{15}}$

(d) $\frac{4}{\sqrt{15}}$

9. At which x value does the graph of $y = 3x^2 - 10x + 15$ have a horizontal tangent line?

(a) $\frac{-3}{5}$

(b) $\frac{5}{3}$

(c) $\frac{-5}{3}$

(d) $\frac{3}{5}$

10. Find $\frac{dy}{dx}$ if $x^2 + 4xy + 2y^2 = 16$

(a) $\frac{-2(x+y)}{x+2y}$

(b) $\frac{-2(x+y)}{2x+y}$

(c) $\frac{-x+2y}{x+y}$

(d) $\frac{-x-2y}{2x+2y}$

11. At which x value(s) does the graph of $y = 2x^3 - 24x + 16$ have a horizontal tangent line?

(a) 2

(b) 1

(c) 2 and -2

(d) 1 and -1

12. If $h(x) = f\left(x^2 + 1\right)$ then which of the following is true?

(a) $h'(x) = f'(2x)$

(b) $h'(x) = 2xf'(2x)$

(c) $h'(x) = 2xf'\left(x^2 + 1\right)$

(d) $h'(x) = f'\left(x^2 + 1\right)$

13. If $f(x) = 10x^2 - 5$, what is the average rate of change of $f(x)$ over the interval

$$-1 \leq x \leq 2$$

(a) 30

(b) 20

(c) $\frac{20}{3}$

(d) 10

14. If $h(x) = f(x)g(x)$ and $f(5) = 3, f'(5) = -1, g(5) = -\frac{1}{2}, g'(5) = 2$, then what is the value of $h'(5)$?

(a) $\frac{13}{2}$

(b) $-\frac{9}{2}$

(c) $\frac{9}{2}$

(d) -2

15. If $f(x) = \sin\left(x^2 + 1\right)$ then find $f''(x)$

(a) $-4x^2 \sin\left(x^2 + 1\right) + 2\cos\left(x^2 + 1\right)$

(b) $4x^2 \sin\left(x^2 + 1\right) - 2\cos\left(x^2 + 1\right)$

(c) $-4x^2 \sin\left(x^2 + 1\right) - 2\cos\left(x^2 + 1\right)$

(d) $4x^2 \sin\left(x^2 + 1\right) + 2\cos\left(x^2 + 1\right)$

16. The height (in feet) of a ball thrown vertically upward is given by

$$s(t) = -16t^2 + 32t + 64$$

where t is in seconds. What is the velocity of the ball at time $t = 3$ seconds?

(a) 64ft/s

(b) -16ft/s

(c) 16ft/s

(d) -64ft/s

17. At which point on the graph is the slope of the tangent line closest to the average rate of change of $f(x)$ between points X and Y?

(a) B

(b) C

(c) D

(d) E

(e) A

18. Let $f(x) = x^3 - 6x^2 + 10$. At which point(s) on the graph of f is the tangent line parallel to the line $15x - y = 11$?

(a) $(2, -6)$ and $(-2, -22)$

(b) $(5, -15)$ and $(-1, 3)$

(c) $(5, -15)$ and $(2, -6)$

(d) $(2, -6)$ and $(-2, 22)$