

Pre-Calculus Answers

Individual

- | | | |
|-------|-------|-------|
| 1) c | 11) a | 21) a |
| 2) a | 12) b | 22) d |
| 3) b | 13) b | 23) c |
| 4) d | 14) d | 24) a |
| 5) e | 15) b | 25) c |
| 6) e | 16) e | 26) a |
| 7) c | 17) b | 27) c |
| 8) c | 18) a | 28) d |
| 9) b | 19) d | 29) d |
| 10) e | 20) c | 30) d |

Team

- 1) 1.
- 2) 1
- 3) 5181
- 4) $\frac{5 \ln 2}{4}$ or $1.25 \ln 2$ or $\ln 2^{5/4}$ or $\ln 2^{1.25}$
- 5) $2/5$ or $.4$
- 6) 140
- 7) 96
- 8) $1 - 2b^2$
- 9) 25
- 10) $\{-1 + i\sqrt{3}, 1 - i\sqrt{3}\}$
- 11) $-35i - 10j + 10k$
- 12) 15.67%
- 13) 9477
- 14) 22.5 or $\frac{45}{2}$
- 15) 183.75 or $\frac{235}{4}$

Precalculus Individual

Hillsborough
3/96

1. $f(0) + 2f\left(\frac{3-0}{0+1}\right) = 0 \Rightarrow f(0) + 2f(3) = 0 \Rightarrow f(0) = -2$
 $f(3) + 2f\left(\frac{3-3}{3+1}\right) = 3 \Rightarrow 2f(0) + f(3) = 3 \Rightarrow f(3) = -1$ (C)
2. $\tan x, \sin 2x, \cos(90-x) = \sin x$ are odd, $\sin(90-x) = \cos x$ is even (C)
3. $\frac{3}{4} + \frac{2}{x} = 18 \Rightarrow \frac{1}{x} = 4 \Rightarrow \frac{1}{4} + \frac{1}{3} = \frac{7}{12}$ (B)
 $\frac{5}{4} + \frac{3}{x} = 29 \Rightarrow \frac{1}{x} = 3$
4. $.6 \cos x + .8 \sin x = .4 \Rightarrow \cos(x - 53.13^\circ) = .4 \Rightarrow$
 $x - 53.13^\circ = 66.42^\circ, 293.58^\circ \Rightarrow x = 119.55^\circ, 346.71^\circ$ (D)
5. for $-1 < A < 1$ there are 4 solutions and for $A = 1, -1$ there are 2 solutions (E)

17.5

6. $2x^2 - xy - y^2 + 13x - y + 20 = (x - y + 4)(2x + y + 5) = 0$ (E)
7. $4 < 5 \rightarrow$ hyperbola (C)
8. $\cos \theta = \frac{2(1) + 4(4) + 1(3)}{\sqrt{4+16+1} \sqrt{1+16+9}} \approx .999 \rightarrow \theta = 26.01^\circ$ (C)
9. $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = f'(x) = 3x^2 + 6$ (B)
10. Dist. to line = Dist. to point
 $\frac{3(x) - 4(y) + 4}{5} = \sqrt{(x-0)^2 + (y-2)^2} \Rightarrow 16x^2 + 24xy + 9y^2 - 74x - 68y + 109 = 0$ (E)
11. $(p \vee q)' = (p)' \wedge (q)' = (p \wedge q)'$ (A)
 $(q \leftrightarrow r)' = (q \leftrightarrow r) \vee (q' \leftrightarrow r')$

12.
$$\begin{array}{r} \overline{) x^3 + 6x^2 + 7x + 9} \\ - (x^3 - 7x^2 - 8x) \\ \hline 13x^2 + 15x + 9 \\ - (13x^2 - 91x - 104) \\ \hline 106x + 113 \end{array}$$

 $x^2 - 7x - 8 = (x - 8)(x + 1) = 0$
 $x = 8, -1$ (neither are roots of numerator) (B)

13. $P(\text{John winning}) = \frac{1}{5} + \left(\frac{4}{5} \cdot \frac{3}{4} \cdot \frac{2}{3}\right) \cdot \frac{1}{5} + \dots = \frac{\frac{1}{5}}{1 - \frac{2}{5}} = \frac{3}{8}$
 $a = \frac{1}{5}, r = \frac{4}{5} \cdot \frac{3}{4} \cdot \frac{2}{3} = \frac{2}{5}$ (B)

14. $4(-x + 6 + 2) - x(x^2 - 9x + 12 - 12) - 5(x - 2 - 6) = 90$
 $x^3 - 8x^2 + 9x + 18 = 0 \Rightarrow (x - 6)(x - 3)(x + 1) = 0$
 $x = 6, 3, -1$ (D)

15. $f(3z + 1) = 9z^2 + 3z - 6 = 3(3z - 2)(z + 1) = 0 \Rightarrow z = \frac{2}{3}, -1$
 $3z + 1 = 2x - 1 \Rightarrow x = \frac{3z}{2} + 1 \Rightarrow x = 2, -\frac{1}{2}$ (B)

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16. $\frac{7 + \frac{23}{60}}{12} - \frac{23}{60} = \frac{x}{60} = \frac{7 + \frac{4}{60}}{12}$
 $x = 53 \frac{4}{11} \rightarrow 7:53 \frac{4}{11}$ (E)

17. $[.9] + [-3.14] + [2.718] = 1 - 4 + 2 = -1$ (B)

18. $r = 3 \cos \theta \Rightarrow r^2 = 3 - \cos \theta \Rightarrow x^2 + y^2 = 3x \Rightarrow$
 $(x - \frac{3}{2})^2 + y^2 = (\frac{3}{2})^2 \quad A = \pi (\frac{3}{2})^2 = 2.25\pi$ (A)

19. $x = y = 1 \Rightarrow (4 - 2)^9 = 512$ (D)

20. $\frac{1}{2} ab \sin C = \text{Area} \Rightarrow \frac{1}{2} (50)(4) \sin C = 36 \Rightarrow \sin C = .310 \Rightarrow$
 $C = 181.920^\circ$ (C)

21. $\uparrow 10\% \quad x = 3(10) = 30 \text{ km} \quad d = \sqrt{x^2 + y^2} = 37.5$
 $\uparrow 15\% \quad y = 1.5(15) = 22.5 \text{ km}$ (A)

22. $x(1 + \frac{.05}{4})^{4(1)} + (5000 - x)e^{-.06} = 5400$
 $1.092x + 5309.18 - 1.0618x = 5400$
 $.0206x = 90.82 \Rightarrow x = 4409.54$ (D)

23. $r + t = 1 \Rightarrow r = \frac{1}{t} \Rightarrow t = \frac{1}{r}$
 $B + G = \frac{1}{6}$
 $N + G = \frac{1}{5}$
 $N + B = \frac{3}{11}$
 $2(N + B + G) = \frac{19}{660}$
 $t = \frac{660}{181} = 3 \frac{117}{181}$ (C)

24. $x^2 + y^2 + Cx + Dy + E = 0$
 $(x + \frac{C}{2})^2 + (y + \frac{D}{2})^2 = \frac{C^2}{4} + \frac{D^2}{4} - E$
 $C(\frac{-C}{2}, \frac{-D}{2}) = (2, 1)$ (A)

$36 + 16 + 6C + 4D + E = 0$	}	$C = -4$
$25 + 25 + 5C + 5D + E = 0$		$D = -2$
$4 + 36 + 2C + 6D + E = 0$		$E = -20$

25. $\frac{\cos^4 x - \sin^4 x}{\cos^2 x - \sin^2 x} = \frac{(\cos^2 x + \sin^2 x)(\cos x - \sin x)(\cos x + \sin x)}{(\cos^2 x + \sin^2 x)(\cos x - \sin x)} = \frac{\cos x + \sin x}{1 + \cos x \sin x}$ (C)

26. $(7^{12} \equiv 1) \pmod{13} \Rightarrow ((7^{12})^9 \equiv 1^9) \pmod{13} \rightarrow (7^{96} \equiv 1) \pmod{13}$
 $(7^{99} \equiv 5) \pmod{13}$ (A)

27. $ar^2 = ar + 80 \Rightarrow \frac{ar(r-1)}{a(r-1)} = \frac{80}{16} \Rightarrow r = 5 \Rightarrow a = 4 \quad ar = 20$ (C)

28. $\sin(A \sin^{-1} \frac{12}{13} + A \tan^{-1} \frac{3}{5}) = \sin(A \sin^{-1} \frac{12}{13}) \cos(A \tan^{-1} \frac{3}{5}) + \cos(A \sin^{-1} \frac{12}{13}) \sin(A \tan^{-1} \frac{3}{5})$
 $= \frac{12}{13} \cdot \frac{5}{\sqrt{34}} + \frac{5}{13} \cdot \frac{3}{\sqrt{34}} = \frac{45}{13\sqrt{34}} = \frac{45\sqrt{34}}{442}$ (D)

29. $(-2k^2)^2 - 4(3k)(9) = 0 \rightarrow 4k^4 - 108k = 0 \rightarrow$
 $4k(k-3)(k^2 + 3k + 9) = 0 \quad k = 0, 3, -1.5 \pm 1.5i\sqrt{3}$ (D)

30. $4 \sin^2 x - 3 \sin x + 1 - \sin^4 x = 0 \Rightarrow 2 \sin^2 x - 3 \sin x + 1 = 0$
 $(2 \sin^2 x - 1)(\sin x - 1) = 0 \Rightarrow \sin x = \pm \frac{1}{2} \Rightarrow x = \frac{\pi}{2}, \frac{5\pi}{6}, \frac{3\pi}{2}, \frac{7\pi}{6}$