I. DOCUMENT PURPOSE

At the October 2024 "We Robot" event, Elon Musk predicted the Tesla Optimus robot would retail for "20 or 30 thousand dollars" once production is scaled. Given the vast physical and intellectual capabilities of the Optimus, and the myriad personal and commercial use cases for it, we hypothesized that this price point is too low.

In this memorandum we answer the following question: *What should the Optimus price be?*

EXECUTIVE SUMMARY

In this memorandum we draw the following conclusions:

- Consumer Interest: We conducted in-person surveys with current Tesla owners and prospective Tesla automobile customers. 93% of survey participants reported an interest in purchasing Optimus.
- Long-Term Price: The median respondent stated a $25,000 purchase willingness-to-pay ("WTP"), and a $500/mo. lease WTP. We believe there is scaled long-term demand at this price point.
- Launch Price: The top quartile respondent stated a $40,000 purchase WTP, and a $1,000/mo. lease WTP. We believe there is scaled early adopter interest at this price point.
- Competitive Threat: While dozens of companies have announced plans to construct humanoid robots, and many have executed key research partnerships, Tesla remains the only market participant with any experience manufacturing, selling, and servicing hardware at scale.
- First Mover Advantage: As we have observed in autonomous driving, the first scaled manufacturer of humanoid robots will collect the most high-quality training data to improve its AI systems. This data advantage will deliver market-leading AI performance with less costly hardware, giving a long-term cost advantage. Tesla's neural nets and manufacturing scale position the company well to be this first mover.
- Pricing Strategy: Given the existence of early adopters with a significant WTP, the inevitability of production-related delivery constraints in early years, and the absence of entrenched incumbents or competitors, Tesla should price high at $40k initially, then reduce prices to $25k over time as competition and production capacity increase.
- Lease vs. Buy Arbitrage: Customer WTP for a lease is disproportionately higher than for a purchase. The implied purchase WTP at *median* leasing rates is $47k, an 88% premium to stated customer purchase WTP of $25k. The implied purchase WTP at *top quartile* leasing rates is $94k, a 135% premium to stated customer purchase WTP of $40k. Given this disparity, Tesla should push leasing models for personal use cases. This disparity suggests upside to the $25k and $40k long-term and early adopter WTPs, respectively, that we suggest above.
- Industrial Use Cases: We expect businesses will, on average, be willing to pay up to $2,500/mo. to replace minimum wage workers for single-shift jobs (e.g. retail), and up to $6,250/mo. for round-the-clock jobs (e.g. warehouse).
- New Economic Models: While the economic potential of selling or leasing the Optimus hardware is the most obvious and immediate opportunity to Tesla, we do not expect it to be the largest economic opportunity in the long-run. We see significant upside from:
  1) Flexible Labor Supply: Tesla should create a marketplace for Optimus owners to lease their robots back to the Tesla fleet, addressing a multi-trillion-dollar market need by supplying the world's most flexible workforce. It can deploy these robots at scale when surge labor is needed during natural disasters and wartime. In peacetime, it can deploy these robots as gig workers. This potential is compounded by Tesla's forthcoming robocab fleet, which will autonomously transport Optimus robots.
  2) Platform Economics: In the same way that Apple controls the operating system of its scaled iPhone hardware today, Tesla will control the operating system of its scaled Optimus hardware. In instances in which Optimus must be trained on specific data to complete a unique task (e.g. personal training), app developers will sell upgrades to Optimus, and Tesla will take a platform fee comparable to Apple's 30%.

II. OPTIMUS CAPABILITIES

In various forums, Elon Musk and other Tesla executives have presented Optimus as a robot that will have the physical strength to do most industrial jobs, the dexterity to do household tasks, and the intelligence of the latest Large Language Models (LLMs). To view the exact language we used to describe Optimus to research participants, see **Appendix A**.

Most products – innovative though they may be – are iterations of the things they seek to replace. Rideshare apps like Uber, for example, were iterations on the same service provided by taxis. The Tesla Roadster, an early EV, was an iteration on an internal combustion sports car manufactured by Lotus. In these cases, and most others, prices for new products anchor on that which they seek to replace. Uber priced their rides to be competitive with Taxis, and Tesla priced their Roadster to be competitive with Lotus.

Occasionally an invention like Optimus comes along, which folds many different functions into a single product, and creates a category of its own. The last time this happened was when Apple launched the iPhone in 2007. Before that, it was the Personal Computer in 1981. Like the transformational products that preceded it, Optimus has no clear pricing comparable, and thus provides us with a particularly interesting case study of how to price a product based on the fundamentals of consumer demand.

III. PRICING STRATEGIES (GENERAL)

When introducing a new product, we find that companies follow one of two strategies:

1) Price Low, Raise Later: Companies price a product equal to or less than the marginal cost to produce, fighting to drive scaled adoption, win marketshare, and/or win trust. For example, Uber heavily subsidized rides when it launched to win marketshare from taxis, fend off competition from Lyft, and convince customers that it was safe to ride in a stranger's car. Once customers became hooked, Uber raised prices.
2) Price High, Lower Later: Companies price according to the willingness-to-pay (WTP) of early adopters, extracting significant profits before competitors come to market. For example, Tesla priced the first production lot of its Model X, the first electric SUV, at $144,000 per vehicle to cater to enthusiasts who just had to have the car no matter the price. As competitors produced electric SUVs of their own, Tesla lowered the Model X price and began producing a lower-cost electric SUV, the Model Y.

For a summary of each pricing strategy, see **Figure 1**.

Figure 1: Pricing Strategy Summary & Expanded Examples

	Price Low, Raise Later	Price High, Lower Later
Select Strategy If...	• Entrenched incumbent (e.g. Taxis) • Strong competition (e.g. Lyft) • Trust issues (e.g. riding in a stranger's car)	• Early adopters with high WTP (e.g. Tesla Model X) • Lack of competition (e.g. no other EV SUVs)
Examples	• Rideshare (e.g. Uber) • Meal Delivery (e.g. DoorDash) • Smart Home (e.g. Alexa) • Cloud Storage (e.g. Dropbox) • Subscription Video On Demand (e.g. Netflix) • Generative AI (e.g. ChatGPT).	• Prescription Drugs (e.g. Ozempic) • Consumer Electronics (e.g. smart phone) • Gaming Software (e.g. Grand Theft Auto V) • Electric Vehicles (e.g. Tesla Model X).

IV. PRICING STRATEGY (OPTIMUS)

To select which pricing strategy Optimus should follow (see **Figure 1**), we must answer the following questions:

- Are there early adopters with a high willingness-to-pay (WTP)?
- Do consumers have trust issues?
- Does an entrenched incumbent exist?
- Does strong competition exist?

Early Adopter Willingness-To-Pay & Consumer Trust
The survey research we commissioned (see **Section V**) confirms that 1) early adopters do have a high WTP, and 2) a significant consumer population does not have trust issues.

Does an Entrenched Incumbent Exist?
We must segment industrial use cases of Optimus vs. personal use cases of Optimus.

For industrial use cases, clear incumbents exist. In some cases, these incumbents are humans. Optimus' capabilities will allow it to replace many low-skilled workers, and thus the incumbent cost is the monthly cost of employing a minimum wage worker ($2,500-$6,250[1]), and the incumbent efficacy is the speed and error rate of these minimum wage workers. In other scenarios, the more general use Optimus robot will replace other, specialized, robots. In these scenarios, the incumbent cost is the amortized monthly costs of these specialized robots, and the incumbent efficacy is the speed and error rate of these specialized robots. Given the high degree of efficiency that specialized robots operate at (e.g. automobile assembly), we think it is unlikely that Optimus will challenge these robots. We think it is much more likely that Optimus will challenge general, low-skilled work performed by minimum wage human workers.

For personal use cases, incumbents exist and are fragmented. Many affluent families rely on an army of tutors, nannies, housekeepers, chefs, gardeners, and handymen to complete household tasks. Generally, the incumbent cost and efficacy for personal use cases increase with homeownership incidence, parental status, and income. In major cities, the incumbent personal costs for homeowning families that can be replaced by an Optimus robot exceed $1,500 per month.[2]

In both industrial and personal use cases, we find that incumbents do exist, but we believe these incumbents are not entrenched. Whether it is a general manager of a warehouse evaluating their fulfillment staff, or it is the head of a household evaluating their personal support staff, efficiency and cost will win.

Does Strong Competition Exist?
Many companies have announced plans to manufacture humanoid robots at scale. A summary of selected competitors can be found in **Figure 2**.

Each of these companies is working to solve the same fundamental engineering problem of vision AI. Robots must be able to see their surroundings, contextually understand what they should do next, and safely execute that next move. Tesla will lean on the AI neural networks that power the industry-leading Full Self Driving product in their automobiles. Figure and 1X will lean on OpenAI, and the omnimodal capabilities it has deployed in GPT-4o. All robotics companies will leverage commercially available AI training solutions from NVIDIA, including Isaac and Omniverse.

Document Continues on Next Page

[1] While the Federal minimum wage is $7.25 per hour, the minimum wage in many states is $15 per hour or higher. For conservatism, we use a $12.50 per hour wage in this analysis, which approximates the GDP-weighted minimum wage in the United States. Again, this estimate is conservative as many scaled employers, like Amazon, voluntarily pay their low-skill workers minimum wages exceeding $20/hr. At a $12.50 hourly wage, with 2,000 working hours per year, the monthly pay of a low-skill worker is $2,083.33. The true cost of employing these individuals is higher, however, due to social security taxes, health benefits, workman's compensation claims, and shared resources supporting these employees (e.g. human resources). To approximate the true monthly cost of a low skilled worker, inclusive of these ancillary costs, we use $2,500 in this analysis. Given that an Optimus robot can work 24/7, we assume that each Optimus robot works at least 2.5 shifts per day, leaving ~4 hours per day for charging and maintenance. Thus, the incumbent replacement cost of an Optimus robot is $2,500/mo. in use cases in which the robot can only work during daytime hours (e.g. handyman work), and is $6,250/mo. in use cases in which the robot can work around the clock (e.g. warehouse work).
[2] Assumes personal support staff of affluent individuals in major cities: $200/mo. food subscriptions (e.g. Blue Apron) and/or delivery (e.g. DoorDash), $1,000/mo. nanny/babysitting, $100/mo. gardening, $100/mo. housekeeping, $50/mo. car washes, $50/mo. low-skill handyman work.

Figure 2: Competitive Product Summary (Non-Exhaustive)

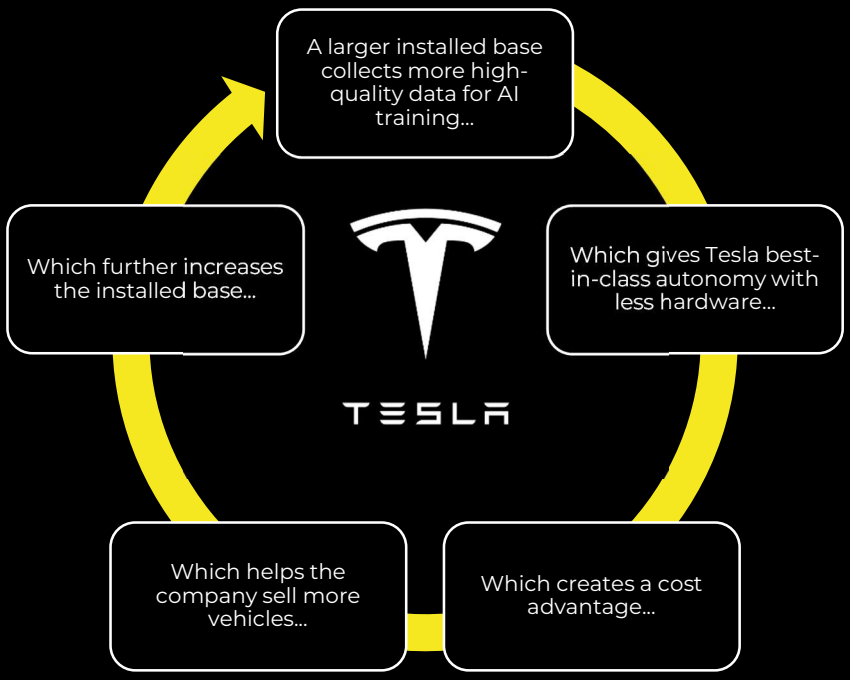
Name	Optimus	G1	02	NEO	Electric Atlas	Digit	Phoenix Gen 7
Company	Tesla	Unitree	Figure	1X	Boston Dynamics	Agility Robotics	Sanctuary AI
On-Sale Date	2026	2024[3]	n.a.	2024[4]	n.a.	2024[5]	n.a.
Price	$20-$30k	$16k	$20k	$20k	n.a.	n.a.	n.a.
Key Partners	n.a.	n.a.	OpenAI, Microsoft, Nvidia	OpenAI	Hyundai	Amazon, Ricoh	Gov't of Canada

We expect multiple companies to solve the vision AI problem, but Tesla will have a significant advantage when they bring their product to market because they are already a scaled company. No robotics competitor has manufactured, sold, or serviced a hardware product at scale.

We believe the first mover in humanoid robotics will derive a sustained competitive advantage from their ability to collect a higher quantity of training data. This advantage is analogous to Tesla's advantage in autonomous driving. With over 5 million vehicles on the road, many of which utilize Full Self Driving mode during periods in which Tesla enables a free trial, the company collects vastly greater data than competitors like Waymo, with its fleet of 700 cars, and thus can achieve a comparable level of autonomy with significantly less expensive hardware.[6]

This larger installed base becomes a self-sustaining advantage. A larger

Figure 3: Tesla's Installed Base Gives It a Self-Sustaining Advantage



[3] Available for research only.
[4] Limited in-home tests in 2024, with scaled release planned by 2027.
[5] Partnership deliveries in 2024. General availability in 2025.
[6] Tesla's autonomous driving relies on cameras only. Due to the simplicity of the hardware and the scale of manufacturing, entry-level Tesla automobiles (Model 3 & Y) can be had for under $45,000, excluding federal subsidies. The low manufacturing volume and increased complexity of Waymo's self-driving system, has driven the company's reported per-vehicle cost to $250,000.

installed base improves the efficacy of the AI, which allows Tesla to achieve best-in-class autonomy with less hardware, which creates a cost advantage, which helps the company sell more vehicles, which increases the installed base and further improves the efficacy of the AI. This flywheel is summarized graphically in **Figure 3**.

Pricing Implications
In summary:

- There are early adopters with a high WTP.
- Early adopters do not have trust issues.
- Incumbents are not entrenched.
- Competitors will not challenge Tesla's position as a first mover.

With these market dynamics, Tesla should price high, then lower prices over time as competition increases. The next section of this document proposes an initial listing price to extract profits from early adopters and a long-term equilibrium price.

V. PRICING RECOMMENDATION (OPTIMUS)
To gauge consumer WTP for Optimus, we surveyed Tesla owners[7] and prospective Tesla automobile customers. We selected this sample of owners and prospective customers because these individuals are more likely to be open to purchasing other products from Tesla in the future, and because they are a financially qualified buyer pool for Optimus.

Our survey began with a brief description of Optimus' capabilities, then posed three questions:

1) What would you pay to buy this robot?
2) What would you pay per month to rent this robot?
3) Do you currently own/lease a Tesla vehicle?

The results of this survey are summarized in the below **Figure 4**, and full respondent data and survey methodology are included in **APPENDIX A**.

Figure 4: Optimus WTP Survey Summary

	Qualifiers		Optimus WTP						
				Buy Price			Rent Price		
Participants	Current Owners (%)	Prospective Owners (%)	% Open to Purchasing[8]	Average	Median	Top Quartile	Average	Median	Top Quartile
40	70%	30%	93%	$32k	$25k	$40k	$774	$500	$1,000

Results Analysis
Our conclusions from this data are the following:

- Astronomical Take Rate: 93% of respondents were open to purchasing the Optimus robot[8]. For comparison, 66% of iPhone owners also own an iPad, and less than 40% of iPhone owners also own a Mac computer.[9] These figures are not directly comparable, as the iPad and Mac take rates represent actual transactions at specific prices, while the Optimus take rate allows respondents to set their own prices. Still, we are impressed with this degree of openness, particularly given that approximately one-third of respondents had zero prior exposure to the Optimus robot before the survey.
- Median WTP Consistent with Tesla Estimates: The median WTP of $25k falls precisely in the middle of the $20-$30k price range proposed by Elon Musk at Tesla's "We Robot" event. Given that NEO and 1X have forecasted similar long-term prices for their humanoid robots (see **Figure 2**), we expect that industry participants, including Tesla, have commissioned their own pricing studies that confirm median WTP data similar to our own. **We believe the median WTP of $25k will be the long-term equilibrium price for humanoid robots.**
- Top Quartile WTP Can Serve Early Adopters: As with any new hardware product, Tesla's first waves of Optimus deliveries will be production constrained. Given these production constraints, Tesla should price Optimus to

[7] Leaseholders also included.
[8] Percentage of respondents who supplied a non-zero WTP.
[9] CIRP data.

maximize profit from early adopters with the highest WTP. Tesla pursued a similar pricing strategy with the release of their Model X and Cybertruck. **We believe the top quartile WTP of $40k should be the initial sales price of Optimus until competitive products achieve scaled distribution and/or deliveries are no longer capacity constrained.**

Lease vs. Buy Arbitrage

Our survey data revealed a surprising relationship between a customer's WTP to lease Optimus vs. buy Optimus.

With a top Quartile purchase WTP of $40,000 and monthly lease WTP of $1,000, respondents are willing to take on annual lease payments equating to 30% of the product purchase price, implying a breakeven period of owning vs. leasing of 40 months. Lines 5-11 of **Figure 5** compare the relationship of purchase vs. lease WTP for Optimus against other Tesla products.

When compared to other Tesla products, **Optimus respondents are willing to pay significantly *more* to lease Optimus, than to purchase Optimus.**

Figure 5: Lease vs. Buy Arbitrage Analysis

	A	B	C	D	E	F	G	H	I	J
1		Optimus			Cybertruck		Model Y			Full
2		**Top Qrtile**	**Mean**	**Median**	**AWD**	**Cyberbeast**	**LR RWD**	**LR AWD**	**PERF AWD**	**Self Drive**
3	Purchase WTP / Price									
4	Purchase WTP / Price	$40,000	$31,784	$25,000	$79,990	$99,990	$44,990	$47,990	$51,490	$8,000
5	Lease WTP / Price									
6	Lease WTP / Price (per mo.)	$1,000	$774	$500	$899	$999	$299	$399	$599	$99
7	Amount Down (36 mo. lease)	$0	$0	$0	$7,500	$7,500	$2,999	$2,999	$2,999	$0
8	Adj. Lease WTP / Price (per mo.)	$1,000	$774	$500	$1,107	$1,207	$382	$482	$682	$99
9	Buy vs. Lease KPIs									
10	% of Purchase Price paid in Lease per Year	30%	29%	24%	17%	14%	10%	12%	16%	15%
11	Buy Breakeven vs. Lease	40 Months	41 Months	50 Months	72 Months	83 Months	118 Months	100 Months	75 Months	81 Months
12	3 Year Lease Payments				$39,864	$43,464	$13,763	$17,363	$24,563	$3,564
13	*% of purchase price*				*50%*	*43%*	*31%*	*36%*	*48%*	*45%*
14	Residual Value (Price less 3r Lease Pmts)				$40,126	$56,526	$31,227	$30,627	$26,927	$4,436
15	*% of purchase price*				*50%*	*57%*	*69%*	*64%*	*52%*	*55%*
16	Lease WTP-Implied Purchase Price									
17	Avg. 3yr. Model Y Lease PMTs as % Price	38%								
18	3 Year Lease Payments	$36,000	$27,864	$18,000						
19	**Lease WTP-Implied Purchase Price**	**$94,343**	**$73,021**	**$47,171**						

At the conclusion of the survey, we pointed out this lease vs. buy discrepancy to select participants and asked them for feedback. Almost unanimously, these respondents shared that it is easier for them to take on an elevated monthly payment than to pay a significant sum for an up-front purchase. Respondents also shared that it was easier for them to value Optimus on a monthly basis because the expenses Optimus will replace are paid monthly (gardener, babysitter, housekeeper, etc.). As these services are currently rendered by humans, it is impossible to "own" them, and thus respondents struggled to calculate what they *should* pay to own them forever.

From these follow-up interviews with respondents, we conclude that their lease WTP responses are more accurate measures of their true WTP than their purchase WTP responses. As such, we sought to calculate a lease-implied purchase price, which represents the true amount we believe customers would be willing to spend. This calculation is shown in lines 16-19 of the above **Figure 5.**

To calculate this lease-implied purchase price, we looked to the ratio of 3 year lease payments-to-purchase price for Tesla's most popular automobile, the Model Y. Across all three Model Y variants, an average lessee will pay 38% of the

Model Y purchase price via monthly lease payments over a three year term, leaving 62% of the vehicle's purchase price as residual value. Using this 38% lease amount as a gross-up factor, the implied Optimus median purchase WTP is $47,171, and the implied top quartile purchase WTP is $94,343. These implied WTPs offer significant upside to Tesla's own price range of $20-$30k, and the $20k purchase price provided by Figure and 1X.

Given this buy vs. lease disparity, Tesla should push leasing models for personal use cases. Subject to confirmatory research, Tesla should consider adopting lease-implied purchase prices of $94,343 (short term) and $47,171 (long term).

VI. NEW ECONOMIC MODELS

While the economic potential of selling or leasing the Optimus hardware is the most obvious and immediate opportunity to Tesla, we do not expect it to be the largest economic opportunity in the long-run. We see significant upside from Tesla 1) deploying an owned/operated fleet of Optimus robots as a flexible labor supply, and 2) extracting significant platform economics by controlling the Optimus operating system.

Flexible Labor Supply

Tesla should create a marketplace for Optimus owners to lease their robots back to the Tesla fleet, addressing a multi-trillion-dollar market need by supplying the world's most flexible workforce. Owners can deploy these robots at scale when surge labor is needed during natural disasters and wartime. In peacetime, owners can deploy these robots as gig workers. This potential is compounded by Tesla's forthcoming robocab fleet, which will autonomously transport Optimus robots.

Platform Economics

In the same way that Apple controls the operating system of its scaled iPhone hardware today, Tesla will control the operating system of its scaled Optimus hardware. In instances in which Optimus must be trained on specific data to complete a unique task (e.g. personal training), app developers will sell upgrades to Optimus, and Tesla will take a platform fee comparable to Apple's 30%.

END DOCUMENT

APPENDIX A: RESEARCH STUDY SURVEY METHODOLOGY & FULL RESULTS

Disclaimer
We produce these memoranda without compensation, and we bear all research, personnel, and production costs associated with them internally. If we were repeating this analysis for a paying client, we would conduct a more robust, nationwide survey, and we would augment with focus groups.

Survey Recruit
Tesla owners/leaseholders and prospective Tesla owners/leaseholders in California and Nevada. Our surveyors approximated respondent age and gender.

Survey Language
Imagine a robot that can do any household task imaginable - cooking, cleaning, gardening, caring for kids and the elderly, etc.

The robot is equipped with cameras that allow it to navigate your home autonomously, and it does not need to be supervised to complete its tasks. Aside from the time required to charge, it can work continuously, 24 hours per day, 7 days per week.

1) How much would you pay to BUY this Robot?

2) How much would you pay PER MONTH to RENT this Robot?

3) Do you currently own/lease a Tesla automobile?

Survey Results
The full dataset appears in **Figure 6**.

Figure 6 appears on next page

Figure 6: Respondent Data

#	Buy Price	Rent Price	Current Own/Lease	Gender	Age	Collection Locaiton
1	$30,000	$350	Y	M	40+	Primm, NV
2	$100,000	$1,500	Y	M	40+	Primm, NV
3	$35,000	$300	Y	M	50+	Primm, NV
4	$6,000	$300	Y	F	30+	Baker, CA
5	$30,000	$500	Y	M	40+	Baker, CA
6	$20,000	$650	N	M	40+	Baker, CA
7	n/a	n/a	Y	F	50+	Baker, CA
8	$100,000	$2,500	Y	M	40+	Baker, CA
9	$75,000	$2,000	Y	F	30+	Baker, CA
10	$5,000	$300	Y	M	40+	Baker, CA
11	$50,000	$250	Y	F	50+	Baker, CA
12	$40,000	$325	Y	F	30+	Baker, CA
13	$20,000	$750	Y	M	40+	Baker, CA
14	n/a	n/a	Y	F	40+	Baker, CA
15	$5,000	$200	Y	M	50+	Barstow, CA
16	$50,000	$1,500	Y	F	40+	Barstow, CA
17	$10,000	$200	N	M	30+	Los Angeles, CA
18	$10,000	$300	N	F	30+	Los Angeles, CA
19	$30,000	$400	N	F	30+	Los Angeles, CA
20	$30,000	$1,000	N	F	30+	Los Angeles, CA
21	$100,000	$2,000	N	M	30+	Los Angeles, CA
22	n/a	n/a	Y	F	50+	Los Angeles, CA
23	$3,000	$299	N	M	30+	Los Angeles, CA
24	$30,000	$1,000	Y	M	40+	Los Angeles, CA
25	$60,000	$2,000	N	F	30+	Los Angeles, CA
26	$10,000	$250	N	M	20+	Los Angeles, CA
27	$22,500	$1,500	Y	M	50+	Los Angeles, CA
28	$25,000	$250	Y	M	30+	Los Angeles, CA
29	$27,500	$325	Y	F	50+	Los Angeles, CA
30	$30,000	$400	Y	M	20+	Los Angeles, CA
31	$10,000	$1,000	N	F	20+	Los Angeles, CA
32	$20,000	$1,000	N	M	20+	Los Angeles, CA
33	$20,000	$1,000	Y	F	50+	Los Angeles, CA
34	$15,000	$500	Y	F	20+	Los Angeles, CA
35	$50,000	$1,000	N	M	40+	Los Angeles, CA
36	$40,000	$500	Y	M	30+	Los Angeles, CA
37	$10,000	$200	Y	n/a	n/a	Santa Monica, CA
38	$12,000	$1,200	Y	n/a	n/a	Santa Monica, CA
39	$25,000	$800	Y	n/a	n/a	Santa Monica, CA
40	$20,000	$75	Y	n/a	n/a	Santa Monica, CA

Mean	**$31,784**	**$774**
Median	**$25,000**	**$500**
Max	**$100,000**	**$2,500**
75th Percentile	**$40,000**	**$1,000**
50th Percentile	**$25,000**	**$500**
25th Percentile	**$11,000**	**$300**
Min	**$3,000**	**$75**